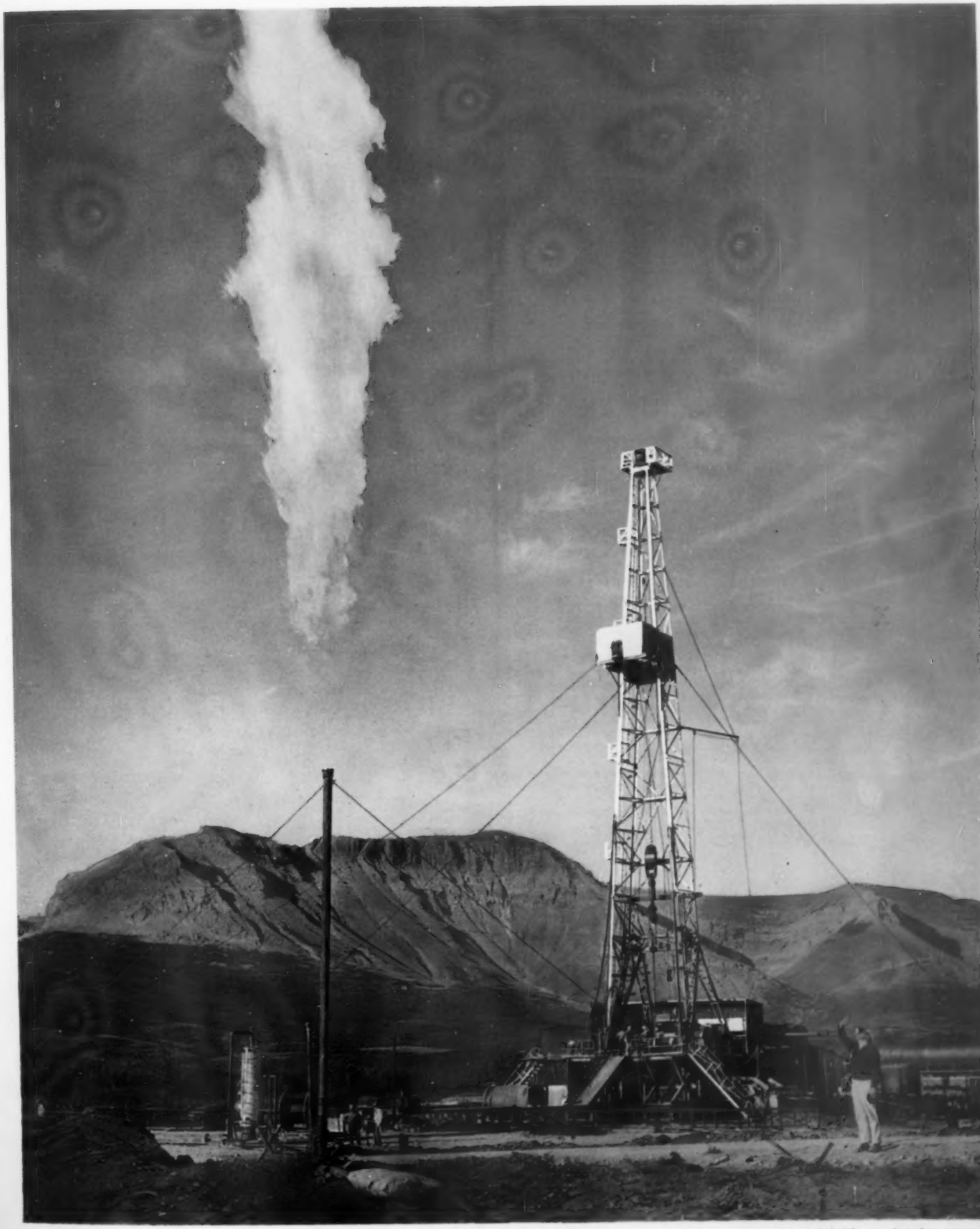
WORLD PETROLEUM

AUGUST 1960



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THE WHOLE PROFIT PICTURE

When you are drilling, all of your equipment, all of your effort, time and money, in fact, your whole profit picture is framed in one simple operation—rotating the bit on the bottom of the hole. Peak efficiency at this point should be your most important consideration. Weight on bit and mud pressure must be maintained at accurate levels to get the job done with safety and the greatest possible profit.

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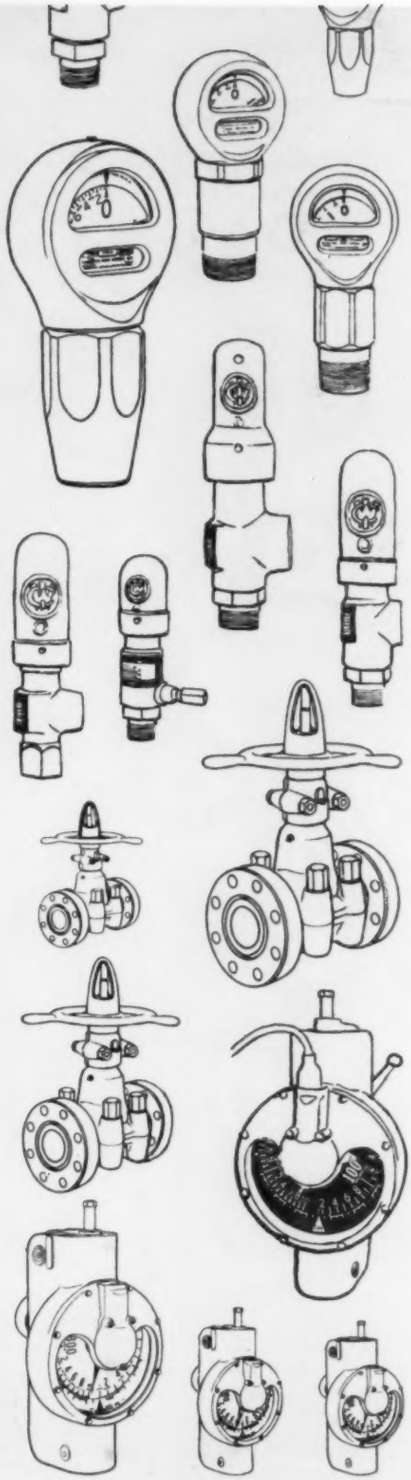

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. . . a quiz for refinery men who want to keep posted

QUESTION 1. At the close of World War II, the vast nation of India had two petroleum refineries with a total capacity of only 10,000 B/D. Today, one of these original production units and three new ones are turning out oil products for India at a considerably greater rate. What is the total crude capacity of India's four operating refineries?

a ▮▮▮▮▮ 43,000 B/D

b ▮▮▮▮▮▮▮▮ 76,000 B/D

c ▮▮▮▮▮▮▮▮▮▮▮ 107,000 B/D

d ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ 144,000 B/D

QUESTION 2. What per cent of India's present refining capacity has been designed, engineered and constructed by Lummus?

a % % % % 39%

b % % % % % % 63%

c % % % % % % % % % 91%

ANSWERS: 1. *(c)—or 107,000 B/D—is the right answer.*

2. *(c) again—or 91% is correct. Lummus has built all three of India's postwar refineries, with a combined capacity of 97,500 B/D, through The Lummus Company Ltd. of London. Lummus Ltd.'s organization matches a staff of over 400 specialists, and has engineered and constructed hundreds of process plants of all types and sizes, from India to Ireland. Lummus Ltd. is one of several international members of the Lummus group of companies which circles the globe. See Lummus on your next project.* •*Statistics according to* World Petroleum.

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World Petroleum

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

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THIS MONTH'S COVER

Lookout Butte No. 1 well, shown adding its bit to Alberta's bright sunshine, was an important wildcat discovery for The British American Oil Co. in 1959. The photo is reproduced here through courtesy of J. H. Yocom, manager, Public Relations Department for B-A.

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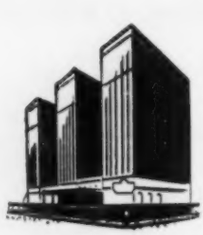

Houston's Welcome to the World

by Joseph B. Huttlinger

Accessory Sales Upheld

Sales commissions to oil refiners on sales of tires, batteries and accessories at their gasoline stations are safe from successful attack in Congress. That's the outlook after the first hearing on a bill to bar the commissions. Congressmen will need two things before they will do anything. One is clearcut evidence that the commissions lead to coercion of dealers to handle only sponsored brands of TBA. The other is support of the Department of Justice and the Federal Trade Commission. Neither is likely to be forthcoming soon.

Rep. James Roosevelt, D., Calif., author of the bill, has been trying for five years to prove coercion, but has yet to satisfy everyone. And DJ and FTC won't change their position until there are convincing evidence and proof that present antitrust laws cannot handle the situation. There's even less chance for the Roosevelt bill to forbid oil refiners from selling gasoline and motor oil at retail.

Chief unit of government to watch for TBA action is the FTC. It is soon to rule whether or not the sales commissions are legal, and should be permitted, or illegal and thus due to be ordered ended. The case has been in the works for years, but finally is near the decision stage.

Private Gas Brands Grow

The private brand gasoline dealer has advanced in the past ten years from a position of selling cheap gasoline in a dirty location, to a factor of real importance in the world of gasoline. As a matter of fact, attorneys for Sun Oil Co. and Pure Oil Co. are trying to prove that the private brand dealer usually has a better and bigger station, and sells gasoline that is the equal of the major brand gasolines. It's part of the defense of the two majors from charges of discrimination when they cut prices to compete with private brand gasoline prices.

A Pure witness, Calvin Houghland, head of the 108-station Direct Oil Co., a private brand outfit, said he sells the "same" gasoline as is sold under brand names such as Gulf, Esso, Cities Service and Sinclair. These are others among his suppliers, he said.

A Sun Oil executive added that the sales to the private brand outlets are at prices lower than majors charge their lessee dealers. The difference is three to five cents a gallon, said Thomas Horrocks, a marketing vice president, and Sun has shunned such sales because it does better selling to lessee dealers at the higher prices.

New Oil Importer

Great Northern Oil Co., Pine Bend, Minn., has just received an allocation to import 10,000 b/d of crude and unfinished oils in

Pipeline

the last half of this year. It took a change in the oil import regulations to swing it.

Great Northern has been obtaining all its crude, about 30,000 b/d, from Canada. Under the regulations, a company which ran no U. S. crude oil, was barred from any quota, whether based on a history of imports or its refinery inputs.

The change in the rules allows a user of all-Canadian or Mexican crude oil a quota. But the Canadian crude still does not count as a refinery input for purposes of how much quota a company can get.

Actually, Great Northern is eligible for a quota of 21,000 b/d, about 75.7% of its imports under the voluntary program. It only asked for 10,000. Great Northern may import the oil from any area of the world and, if it wishes, exchange it for domestic crude. Oil Import Administration officials explained that the change in the rules affects only Great Northern, as there is no other plant which uses only Canadian oil.

US Gas Controls Loom

U. S. producers of natural gas face tougher controls over the prices at which they sell to pipe line companies. This is a far cry from what they have been hoping for

It now seems that a bill to remove price controls is definitely impossible. And a bill to ease up the controls faces odds of about 100 to one. Even with a friendly president in the White House, a bill could not be signed into law. And the new president in January can hardly be expected to be more friendly than Mr. Eisenhower. So, the Federal Power Commission operates price controls over the gas producers, day by day.

When the FPC gets tough, the courts back it up. This happened in cases involving Sun Oil Co. and Sunray Mid-Continent Oil Co. Both companies asked the FPC for certificates to sell gas to pipe line companies for limited periods, of 10 and 20 years respectively. Instead, the FPC gave certificates without time limit. The companies went to court to see if they could stop selling gas at the 10 and 20 year marks. The U. S. Supreme Court has now told them no.

Idea of the companies was that if they could stop selling, they could then sign a new contract with the pipe line company, and file it as an "initial rate." The thought is that the new price would be higher. Now if they want to write a new contract, they must file it as a "changed rate." It is far easier for the FPC to crack down on a "changed" rate than an "initial one."

Gas producers look to the FPC opinion in the case of the Phillips Petroleum Co. to clear up the rules for price control over gas producers. The FPC has been studying the case for more than a decade. Chances are the opinion will be appealed to the courts, so it is years before a pattern will be spelled out.

(*Continued on page 6*)

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Help Grows in Pollution Fight

Dr. Leroy Burney, U. S. Surgeon General, says he is getting "much more cooperation" this year than ever before from the oil and auto industries on cleaning up air pollution by auto exhaust. He told the House Appropriations Committee both industries are making "considerably more contributions" both in their own research and in cooperating with government research. He added, however, that "all of us could and should do more than we are doing at the present time."

Dr. Burney said that at the U. S. Sanitary Engineering Center, Cincinnati, an auto-exhaust test facility has been completed. First studies are designed to study the composition of the exhaust gas. Later, tests will be made of the effect of the gases on animals, vegetables, and the human eye, which often is irritated by exhaust gases.

Mark D. Hollis, associate chief of the Bureau of State Services, told the committee the need for persons to operate the facility accounts for an increase of $375,000 in funds requested for government work on auto exhaust air pollution.

Total budget for air pollution work is $4.9 million for the year starting next July 1. This includes other than auto exhaust pollution.

High Taxes Have Little Effect

High taxes on new passenger cars and tracks and high taxes on gasoline have only slight effects on gasoline consumption, according to a study by Dansk Esso, Jersey Standard affiliate in Denmark.

A study by the company shows that passenger cars are expected to increase from 332,000 last year to 600,000 by 1970, if there is no change in the auto tax of the equivalent of $1,377 per car. If the car tax were cut in half, the total of passenger cars would rise to 655,000, the study estimates.

The use of motor fuel would rise from 1,050,000 liters last year to 1,500,000 if the high tax were continued, and to 1,555,000 liters if it were cut in half, the study goes on. The rises are 43% and 48% respectively.

Danish officials reportedly are considering cutting the auto tax in half and adding 30% to the motor fuel tax to keep the total government income from these taxes at the same level.

Dansk Esso has found that either lowering or raising the gasoline tax would not "greatly affect" car registrations or gasoline consumption.

Auto makers in nearby countries hope for a cut in the auto tax, and German border residents, who cross into Denmark to buy their gasoline, would be unhappy to see a higher gasoline tax.

Clean Restrooms Wanted

One out of five motorists say their "pet annoyance" is the unclean restroom, according to a survey by the American Automobile Association. A total of 20.1% of motorists covered in the survey listed this as the number one "pet annoyance." Some 18.6% listed it as the second and 20.1% listed it in third place.

Only one annoyance—traffic congestion in urban areas—drew more complaints, for one out of four motorists called this the primary gripe. A total of 26.3% listed the city traffic as the number one annoyance, 25% listed it in second place and 17.6% listed it in third place.

Other annoyances of motorists in order were inadequate route marking, 19.4%; trucks and buses, 13.9%; billboards, 9.7%; house trailers, 8.7%; and inadequate services on turnpikes, 1.9%.

Thes AAA survey resulted in a report entitled "The Travel Habits of the AAA Member."

German Dealers Organize

Gasoline dealers of Western Germany have formed the Association of Independent Filling Station Operators, which now represents some 450 to 500 stations with a monthly consumption of 16,000 metric tons of gasoline and six to eight million liters of diesel oil.

Fourteen of the members, with 100 stations have established a purchasing company to insure a supply at the going price in the event major companies reduce or cut off their deliveries, it is reported. The association hopes to embrace most of the 2,200 independent gasoline stations in the Federal Republic and in West Germany.

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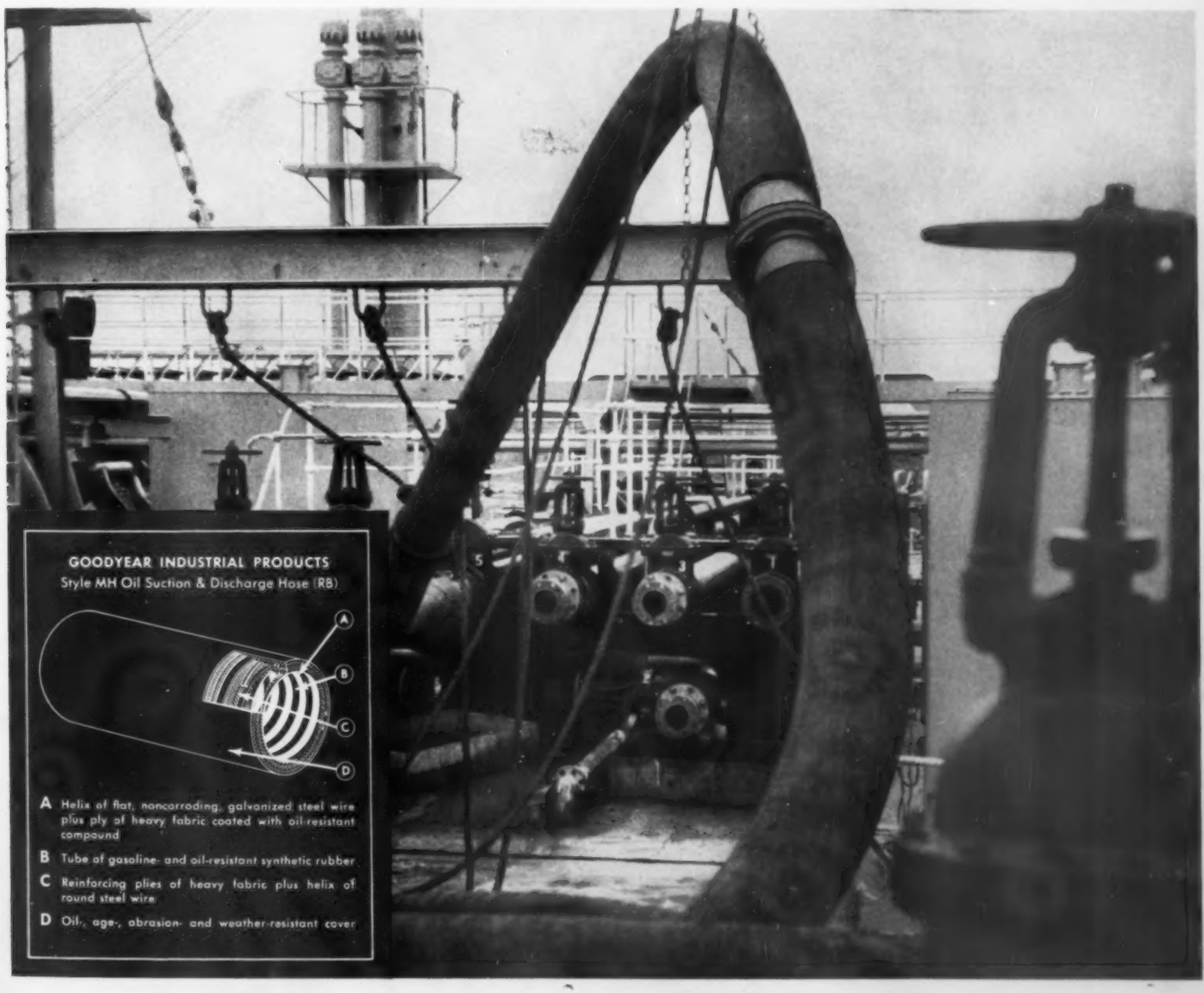
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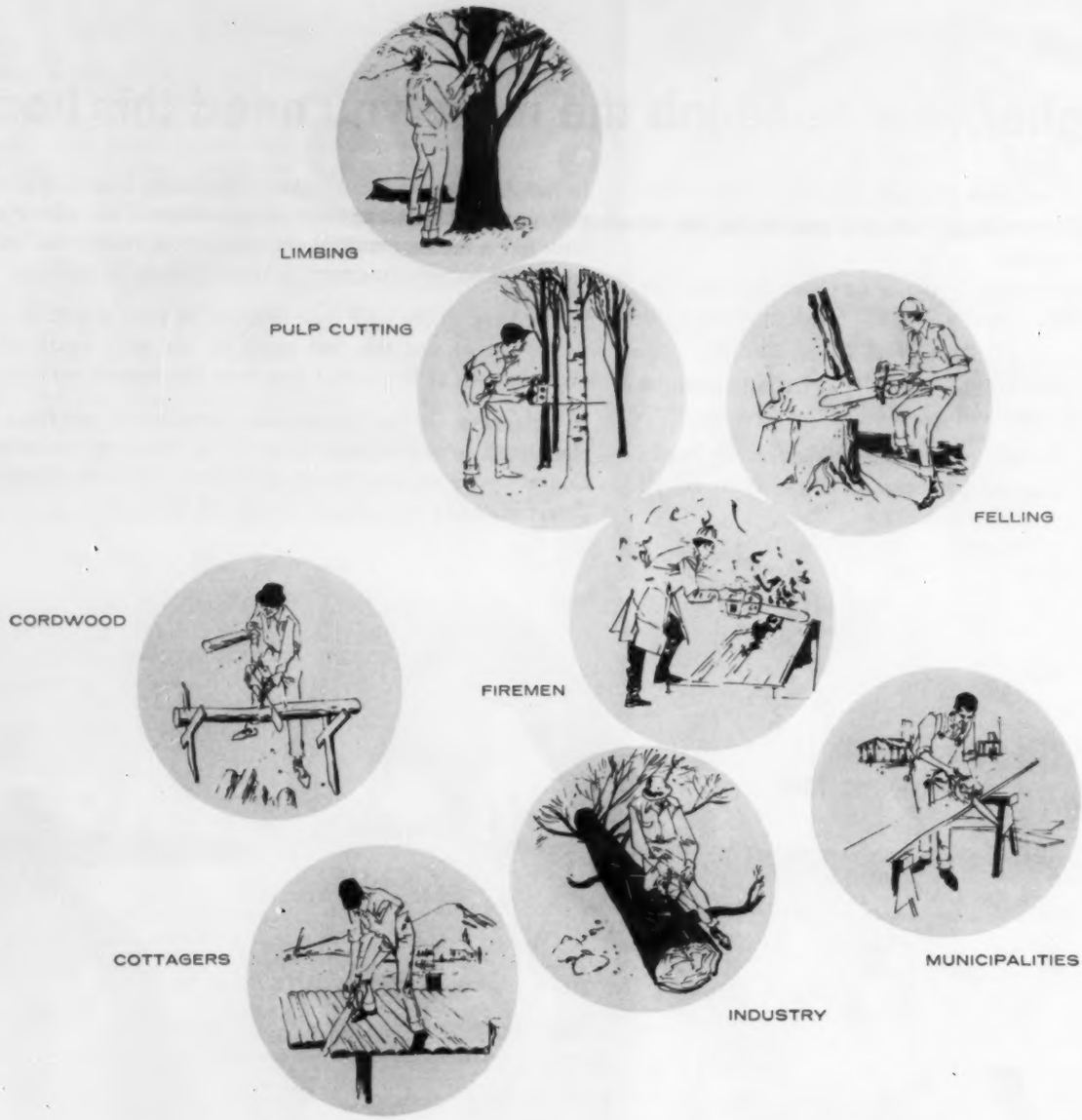

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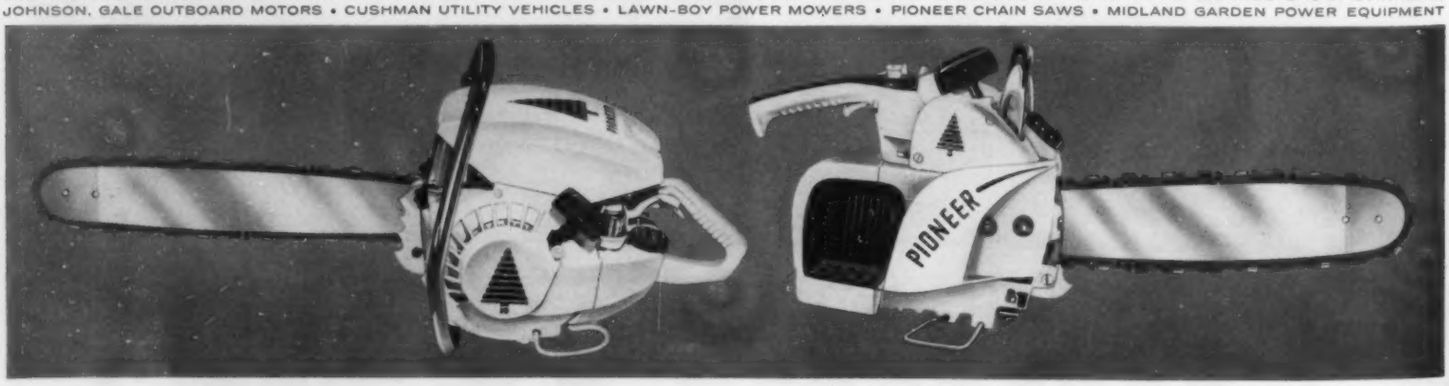

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Fuel Oil Over 50% of Consumption

UK total deliveries of petroleum products into inland consumption (thus excluding bunkers for foreign-going ships) totalled 11.2 million (long) tons in the first quarter of this year, a rise of 2.0 million tons (21.7%) over the same period of 1959. This is higher than last year, when the rise in the first quarter over the same period of 1958 was lower at 1.5 million tons (19.7%). The rise in fuel oil deliveries (excluding refinery consumption) was unprecedented for this period at 1.2 million tons (31.1%), deliveries for the comparative quarters being 5.0 million tons in 1960 against 3.8 million in 1959.

Information collated independently for the UK Petroleum Industry Advisory Committee can be summarized thus:

January to March

	1960		1959	
	Tons	Per cent	Tons	Per cent
Aviation fuels	387,792	3.4	311,177	3.4
Motor spirit[a]	1,646,180	14.7	1,491,604	16.2
Industrial[b] and white spirits	96,684	0.9	84,070	0.9
Kerosine	626,534	5.6	630,013	6.8
Diesel engine road fuel	619,333	5.5	518,682	5.6
Gas/diesel oils	1,010,625	9.0	889,536	9.7
Fuel oil [c]	5,793,838	51.6	4,540,672	49.3
Lubricating oil and grease	236,654	2.1	207,260	2.2
Other products	801,195	7.2	547,278	5.9
Total	11,218,835	100.0	9,220,292	100.0

Notes: [a]Includes motor benzole. [b]Includes industrial benzole. [c]Includes refinery consumption: 1960—816,958; 1959—745,582.

This is the first time deliveries of fuel oil (including refinery consumption) have exceeded 50%. On the basis of the normal proportion represented by the first quarter's total, consumption for 1960 seems likely to be of the order of 44 to 45 million tons, against 36.5 million in 1959.

Equipment Orders Up

The value of orders for materials and equipment (excluding tankers) placed in the UK by oil companies in the first quarter this year totalled £31,020,236, an increase of £1,854,108 (6.4%) over the corresponding 1959 period, and a continuance of the resurgence in the fourth quarter of 1959. These figures are compiled by the Oil Companies Materials Association and, in regard to the current return, Petroleum Information Bureau reports that 62% of the total has been incurred by goods destined for use overseas. This compares with 82% and 72% in the years 1958 and 1959 respectively.

Acetic Acid by a Petroleum Route

Distillers Co. will build a new £2 million acetic acid plant at Hull, with production to start early 1962. This plant will be the first of its kind in Europe and it will use a new process developed by the company and based on the direct oxidation of a light petroleum fraction instead of the normal two-stage route based on ethyl alcohol—which is first dehydrogenated to acetaldehyde and then oxidized to acetic acid. Until 1951 the ethyl alcohol was obtained by fermenting molasses, but in that year ethanol synthesized from ethylene became available from British Hydrocarbon Chemicals at Grangemouth, 50% owned by Distillers. The development of this single-stage process is regarded as a considerable technical advance.

ICI "Know-How" for East Europe

Talks were resumed in London in June between Imperial Chemical Industries and representatives of four eastern European countries—Czechoslovakia, Eastern Germany, Poland and Romania—on the question of purchasing from ICI its "know-how" and other aid in relation to polyethylene production. These talks started in February and were interrupted for the representatives to report back to their governments. Russia is also believed to be interested in arranging a similar deal independently.

Arrangements of this nature in regard to polyester fibers, involving the payment to ICI of several million pounds, have already been made with Czechoslovakia and Poland.

Standstill on Power Station Conversions

The Minister of Power told Parliament recently that two power stations which were to have been converted to oil burning this year would continue to burn coal for at least two more years. The possibility of extending the period would be discussed before the two years expired. The minister was not yet prepared to make any further statement about the longer-term oil contracts for power stations, but said he was not "wholly pessimistic" that it might be possible to achieve more progress. There are no plans at present, he said, to increase the use of oil in power stations.

Lobitos' Offer for MOR

Lobitos Oilfields Ltd. and Manchester Oil Refinery (Holdings) Ltd. announce their agreement that a merger would be of mutual interest and that Lobitos will make a cash offer of 20s. for each 5s. ordinary stock unit of MOR, or £1.62 million for the £405,000 ordinary capital. Full details of the offer are to be issued later but, so far, no mention is made of any offer for the preference capital.

Such a merger would benefit MOR by giving its 175,000 ton/yr Trafford Park (Manchester) refinery greater security of crude oil supply at a reasonable price—a problem which has handicapped the company's financial results for some years. To Lobitos, which owns a 200,000 ton/yr refinery at Ellesmere Port (Cheshire), the merger would fit in with its current UK expansion policy by adding considerably to its refining capacity, and at the same time removing a source of keen competition in a number of specialty products. MOR also has a 40% interest in the Antwerp "Albatros" refinery, whose crude supply agreement with BP ends this year, and Lobitos' Peruvian crude might be able to find an additional outlet here. Last year Lobitos acquired Dussek Brothers Ltd., another independent refiner, specializing in products for the electrical, printing and paint industries.

Change in Nuclear Station Policy

Estimates of UK fuel oil demand, and thus of the pattern of oil consumption as a whole over the next 5 to 10 years, will once again need recasting as a result of changes in coal-to-oil power station conversions and, more especially, the virtual halving of the nuclear power program—what the Minister of Power preferred to call a "deferment of acceleration planned" rather than a "cut-back." The phases to date in this program are perhaps seen clearest in tabular form:

Plan	Program
I 1955	1,500-2,000 megawatts by 1965
II March 1957[a]	5,000-6,000 megawatts by end—1965
III Oct. 1957[b]	5,000-6,000 megawatts by end—1966
IV June 1960[c]	5,000-6,000 megawatts by 1968

Notes: [a]Acceleration ascribed to fuel situation and the further technical progress made.
[b]Setback of plan due to restrictions on capital expenditure.
[c]Five nuclear power stations are now being built and two more have been approved; the earlier stations will come into operation in 1961 and all seven should be operating by 1966, and these will have a total output capacity of about 3,000 megawatts. Henceforth, roughly, one new station will be ordered every year.

The government says that since 1957 coal has become plentiful and oil supply prospects have also improved. Thus the need on fuel supply grounds for an immediate and sharp acceleration in the rate of ordering nuclear capacity has passed. Although oil seems likely to remain plentiful for many years it is believed not wise to rely only upon imported oil to supplement coal.

The government expects individual station capacity to increase and sees the latest program giving the country about 5,000 megawatts of capacity in 1968. It also believes that in 10 years' time it should be cheaper to generate base load electricity in nuclear than in conventional stations provided the technological progress expected is achieved.

Party of lubrication engineers from British Petroleum companies in the test shop in the Perkins service school at Peterborough, England. From left to right, and listening to the guide, are: P. C. Ruttledge, organizer of the visit; P. R. Harvey, BP Southern Africa; A. Marsh, BP Australia Ltd.; M. Mosimann, BPAG Switzerland; B. Novosad, Norsk Braendselolje A/S Norway; J. Stoldt, BPAG Germany; R. Block, BP Belgium; G. H. Burgess, Power Petroleum Ltd., U. K.; W. Ogendahl, BPOK Denmark; and R. Revol, BP Algeria.

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POWERS PROGRESS

Regent Oil's "New Look"

Two new petrols, especially formulated to meet the more critical needs of today's car engines and to overcome current major problems, especially that of carburetor icing, have been introduced by Regent Oil Co. (Caltex group) as the second stage of what it terms its "new look" on the UK market. The first was the introduction, two months earlier, of "Advanced Havoline" lubricating oils.

These petrols are "Regent Supreme," a "peak octane" fuel selling at 4s. 11d. a gallon, and "Regent Super," a "high octane" fuel at 4s. 9d. These replace "Regent 100" and "Regent TT," but the grades "Regent Benzole Mixture" (4s. 8d.) and "Regent Regular" (4s. 3s.) remain. This "new look" is being supported by the introduction of new shape globes (still in the familiar red, white and blue) on the new Wayne computer pumps and by improvements in the appearance and layout of filling stations.

Ultramar Integration Plans

Ultramar Co. announces its intention to issue £3¼ million of convertible loan stock during the summer in order to finance its contribution to the recent integration plans. A special meeting in March approved an increase in capital to £4½ million to permit implementation of the agreement to purchase the shares of Panama Refining & Petrochemical Corp. By May 27th, 97.7% of these shares had been acquired by share exchange. The projects for constructing a 55,000 b/d refinery in Panama with a potential partner and for expanding Golden Eagle Refining Co.'s plant at Torrance, Calif., from 9,000 to 30,000 b/d are under active consideration. Referring to the formation of the 100% subsidiary, Golden Eagle Refining Co. of Canada Ltd. and the agreement with the Newfoundland Government to build a refinery with a minimum capacity of 5,000 b/d, the Ultramar report confirms that this will supply the government with its product requirements for a period of 20 years and says that government support can be counted on in establishing a market for the refinery output with local industries.

Queen's Birthday Honors

H. M. the Queen has appointed Jonkheer J. H. Loudon, president of the Royal Dutch Petroleum Co. and senior managing director of the Royal Dutch/-Shell group, to be an Honorary Knight Commander of the Order of the British Empire (KBE) in recognition of his important contributions to the national economy and to British interests abroad.

The Birthday Honors confer the rank of Officer of the Order (OBE) on A. E. Mason, former managing director of BP Refinery (Kwinana) Ltd. and director of BP Australia Ltd., G. Theaker, secretary of John I. Jacobs & Co. Ltd., tanker owners and brokers, and on Dr. F. B. Thole, lately senior principal scientific officer, Ministry of Power, and previously for many years chief chemist of British Petroleum. Membership of the Order (MBE) is conferred on R. G. Protheroe, manager of Esso Petroleum's Purfleet terminal.

BP Aids Marine College

BP Tanker Co. is providing £20,000 toward the cost of building a new workshop training center at South Shields (Durham) Marine and Technical College. This will provide practical training for apprentice sea-going engineers from shipping companies and BP will send about 100 to 120 a year for an intensive 21-week course. Much of the necessary equipment has already been presented by the company and is in use in other buildings.

Appointments

J. M. STOREY, CBE, managing director of Dewrance & Co. Ltd., and vice chairman of the Council of British Manufacturers of Petroleum Equipment, has been elected chairman and took office in July.

S. G. READ, director of Shell Tankers Ltd., has been appointed manager of its British flag fleet, succeeding **R. I. BARTON-WRIGHT,** who is retiring but will remain in an advisory capacity.

T. C. BAILEY, Shell-Mex and B. P. sales manager for industrial fuels, has retired and is succeeded by **E. RENDALL,** manager of the north-east division, Leeds. Mr. Bailey, a leading authority on liquid fuel firing, has been particularly associated with the development of oil firing in the steel industry. He was president of the Institute of Fuel for 1958-59, one of the very few in the oil industry ever to have this honor.

First delivery of Mobil D.T.E. Oil Heavy Medium to the turbine generating sets during the construction of the Kariba Dam. About 31,000 gal will be delivered. For each turbine, the road tanker has to make two trips from Salisbury 250 miles away.

Kenneth A. Ballard

KENNETH A. BALLARD has set up the firm of K. A. Ballard Ltd. to act as consultants and engineering agents, with emphasis on the petroleum, petrochemical and chemical industries. Mr. Ballard has had extensive experience of these industries' requirements, particularly in the field of valves, pipe fittings and bends with such firms as Samual Osborn & Co., of Sheffield, and Aluminum Plant and Vessel Co.

M. B. CREED has been appointed manager of Shell Chemical Co's southern sales region, succeeding **G. J. ENGLE,** who has retired after service with the Shell group since 1922 and with the chemical side since 1947. Mr. Creed, who joined the group in 1938, has been associated with the chemical sales side since 1948.

DENIS E. ROOKE has been appointed by the Gas Council to take charge of the newly-established Development and Planning Section. Since 1957 he has been seconded to the North Thames Gas Board for investigation work in the US and UK on liquid methane and its transportation. He was one of the technical team in the "Methane Pioneer" which brought the trial cargoes to the UK in 1959-60.

New Publications

"Technical Progress News"—This is a new publication of The Cape Asbestos Co. Ltd., to be issued periodically, in which the latest developments in the thermal insulation field will be reported. It is a pity it has such an "anonymous" title. Two notes of particular interest in the first number describe (a) a Fire Research Station Test which shows that a 2½-in thick mattress of "Rocksil" gives the protection to a ship's steel bulkhead required by the 1948 Convention on Safety of Life at Sea for "A" class Divisions, and (b) some unique insulation problems at the Berkeley nuclear power station. Copies from the company at 114 Park Street, London, W.1.

"The A.B.C. of 'Electronic Brains'"—This reproduces the series of six talks broadcast in the external service of the BBC by Leon Bagrit, deputy chairman and managing director of Elliott-Automation Ltd. The many diagrams and photos add greatly to the understanding of the text, which must interest the uninitiated. Copies from the company at 34 Portland Place, London, S.W.T.

"Road Vehicle Lubrication"—A 76-page publication which gives the commercial operator of goods vehicles a comprehensive guide to the proper lubrication of engine, transmission and final drive. Text is clear and well illustrated in color, and though the last edition (1956) bore the same title, this is virtually a new publication. Copies available from Wakefield-Dick Industrial Oils Ltd., Castrol House, Marylebone Road, London, N.W. 1.

Shell and BP Road Maps—There is no risk of disappointing even the most map-fascinated motorist by asserting that this new series (now 5 miles/inch instead of 6) in full color on tough paper covering the British Isles is the clearest of its scale yet produced. The amount of information given without detracting from clarity is remarkable; yet, among other new features, type size is increased, more minor roads included to aid cross-country travel, and distances between towns are bolder. Each of the five sections will be on sale at BP and Shell garages at 1s. each. No. 1 (Southern England) and No. 2 (Central England and Wales) are already available and the others will follow over the next few months.

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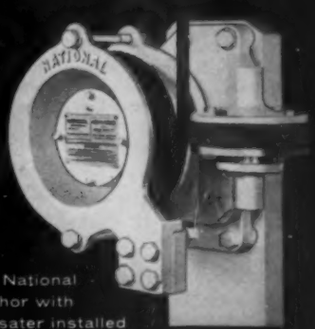

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CANADIAN NOTES

Gas Regulation Occupies CGA

Government regulation and the slow-down in rate of new business growth were the prime topics of concern among the 500 delegates to the 53rd annual meeting of The Canadian Gas Association at Manoir Richelieu, Murray Bay, Quebec, from June 22 to 25. Guest speeches and private discussions alike expounded on the theme that the natural gas industry at all stages, from field production to local distribution utility services, must find some amicable way of policing its own activities. Otherwise it faces the risk of much more serious controls than have yet been imposed by regulatory authorities and other government bodies.

Outlining the functions and policy of the new National Energy Board, its chairman, Ian McKinnon, warned that an atmosphere of public confidence and support must be encouraged by producers, pipe line companies, distributors and appliance manufacturers, which all have mutual responsibility.

Acknowledging that the gas producer must spend a great deal of capital to develop adequate gas reserves for expansion of Canadian demand, Mr. McKinnon asserted that prices must be high enough to ensure recapture of the original investment and a fair profit, in order to sustain an adequate exploration program. However, he said, there must be application of common sense and understanding to the pricing problem. Because of its inherent public service characteristics, the gas industry must be subject to a wide measure of regulation. He challenged the industry to avoid long and contentious hearings by regulatory authorities, especially on pricing. Unduly contentious hearings, he declared, can only lead to still more regulation. Every possible step should be taken, he suggested, to settle price adjustments between the parties concerned, before submitting the case to a public hearing.

The rate of expansion which was expected for 1960 when preliminary estimates were made up last fall has not developed, and all local utility companies except those in special situations are cutting back their forecasts materially. Housing starts across Canada are down approximately 50% from 1959, and it appears that the trend will continue for the whole year. The trend is a symptom of overbuilding and represents a healthy correction, according to utility executives, but the timing of the adjustment caught them all by surprise. For some it is a welcome relief from the obligation to raise more capital for expansion in a period of continuing tight money. For those of more recent origin it is a factor which is creating a problem of large overhead and fixed charges in relation to too few services in operation.

The companies which are least affected are those like Greater Winnipeg Gas Co., which have relatively unsaturated market areas and are not dependent on new housing starts for their projected business.

Among producers and pipe line companies, there was great concern over the declared intention of The Alberta Gas Trunk Line Co. Ltd. to defer a start of construction on its Foothills system until 1961. The continuing delay in the hearing before the Federal Power Commission, by the American affiliates of Alberta and Southern Gas Co. Ltd., on which the construction timing of the Foothills system depends, has compelled Trunk to confirm its earlier forecast that the line will probably not be in operation before the end of 1962. There was some favorable reaction, however, to the statement by Trunk president Alex G. Bailey. Many gasmen feel that interest rates will turn lower before financing has to be done, and this will be a factor of considerable saving, which should be passed on in part to the ultimate consumers.

There was unanimous agreement that 1960 will be the worst year in a long time for main line pipelines, and that 1961 can hardly help being a great improvement.

Canadian Imports To Jump

Canada will import a greatly increased volume of crude this year because of two new refineries in the eastern region. Estimated average will be 356,000 b/d, up from 319,000 b/d in 1959, at 419,000 b/d compared with 415,000 b/d.

Crude Market In Ontario

Ontario will provide hardly any increase in the market for Canadian crude in 1960, according to a long-term forecast. Average of 204,347 b/d will be up only 3% from the 198,438 b/d in 1959. Ontario's oil imports from the USA will double, to 10,000 b/d from 5,400 b/d average.

Gas Export Approved

National Energy Board of Canada has approved amended application by Niagara Transmission Ltd. for export to the state of New York of 16.7 million feet of natural gas a day for 20 years. The applicant, a wholly owned subsidiary of Consumers' Gas Co. of Toronto, was turned down in an earlier application because the board felt the proposed pricing of gas at the border was insufficient to recapture capital and operating costs. The amended application provides a 7.5% rate of return on net investment after taxes. A USA Federal Power Commission examiner had approved the plan in April.

Canadian Completions Drop

Western Canada well completions dropped abruptly in May to total 115, down nearly half from the 220 in May 1959. Bad weather extended spring road bans. Cumulative total for first five months is 1,140 wells, down 95 (9%) from the 1,235 completed in the same 1959 period.

How About Profit On USSR Gas?

Explanation by Canadian Federal government that proposed import of 60 million gallons of USSR gasoline would only displace other imports is challenged by eastern Canadian refiners. They point out loss of profit margin which they would earn on refining equal volume of gasoline from imported crude.

Exploration Rights Released

A substantial volume of exploration permit rights in the Northwest Territories reverted to the Canadian dominion government following definite verdict that non-Canadian companies will be excluded from holding leases. A total of 7.5 million acres was returned during the first week in June.

Canadian Exports To USA Rise

Crude exports to the USA in the first half of 1960 are estimated to average nearly 116,000 b/d, up from less than 84,000 b/d in the comparable 1959 period. Greatest increase has taken place on Puget Sound—responsible for 85% of total growth.

Thumbs Down On LPG Lines

Alberta Conservation Board is expected to turn down all applications for permission to build LPGas pipelines to transport wet-gas liquids out of the province. Four such competing applications have been before it, including three involving export to USA. Considered more likely to succeed are two proposed lines entirely within Alberta, leading to local refineries.

Gas Line Deferred

Major extension of the gas-gathering system of Westcoast Transmission Co. Ltd. will be deferred until 1961. The $100 million project will be a 250-mile 30-in. line direct to a processing plant at Taylor from the new Fort Nelson gas area where four fields are under development. Ultimately Westcoast will spend another $350 million on a main-line loop and on more gathering lines—by 1964 or 1965.

Record 160,850 B/D For Sask.

Saskatchewan will have produced a record high volume of crude during June, as refiners nominated an average of 160,850 b/d.

Geophysical Crews Hit Low

The number of geophysical crews at work in western Canada during May 1960 hit a new 13-year low for that month, at 34 crews. During 1959, there were 56 crews working in May. Exploration contractors expect little pickup this summer, probably averaging 40 crews per month. The year's total may not exceed 700 crew-months, lowest since 1947.

Gas Export Plan Stands

The USA Federal Power Commission rejected a coal-industry plea that it reconsider its approval of Midwestern Gas Transmission Co.'s plan to import natural gas from Canada. Midwestern has a 25-year contract to buy gas from Trans-Canada Pipe Lines Ltd.; but, when Canadian authorities approved an export license for Trans-Canada, the USA coal representatives declared, they made it expire in 1981—less than 21 years. Thus, the USA coal industry contended, adequate export authority had not been granted. The FPC dismissed this argument. The first permit, issued by a lower-level Canadian board, was for 27 years—from May 14, 1954 to the same day in 1981; and this 1981 cutoff date was retained in all later actions by the Canadian government, the FPC contended.

New Canadian Hydrodesulfurizer

Shell Oil Co. of Canada Ltd. will begin construction of a $3 million hydrodesulfurizer early this summer at its Montreal refinery, for year-end completion.

Foothills Gas Discovery

Discovery of natural gas at a relatively shallow depth has been made in the foothills area of southwestern Alberta by a wildcat of Texas Gulf Sulphur and associates. Gas flow reached maximum 8.2 million cubic feet daily from a 120-ft interval below 7,468 ft in Mississippian—a productive zone some 3,700 ft higher than at Shell's Burnt Timber discovery six miles to the east. In the general Burnt-Timber area, the new discovery is about 65 miles northwest of Calgary. The well is projected to 9,500 ft to evaluate the Mississippian.

Personals

PAUL N. HEALD has been appointed manager, manufacturing operations, of Shell Oil Co. of Canada, Ltd. He succeeds **A. J. FOOTE** who has been named assistant manager—Shellburn refinery, Vancouver.

Petroleum Congress Proceedings

All advance orders for the 11-volume Proceedings of last year's Fifth World Petroleum Congress have been filled and new orders are now being accepted, according to E. V. Murphree, Congress chairman. A total of 282 technical papers and discussions, running to more than 4,700 pages, were edited and proof-read in compiling the volumes.

Following is a subject breakdown of the eleven volumes and the number of technical papers contained in each: Vol. I, Geology and Geophysics, 57; Vol. II, Drilling and Production, 31; Vol. III, Oil Processes and Refining, 32; Vol. IV, Chemicals from Petroleum and Natural Gas, 29; Vol. V, Composition, Analysis and Testing, 31; Vol. VI, Utilization of Petroleum Products, 29; Vol. VII, Engineering, Equipment and Materials, 22; Vol. VIII, Transportation and Distribution, 19; Vol. IX, Operations Research, Statistics and Education, 14; Vol. X, Symposium on the Applications of Atomic Energy to the Petroleum Industry, 18. The final volume, entitled the General Volume, describes the organization and events of the Congress and contains the general lectures and speeches, and a list of all Congress members and their addresses.

A limited number of copies are available for purchase from the American Petroleum Institute, Publication Section, 1271 Avenue of the Americas, New York 20, N. Y. Individual volumes are priced at $12.50, plus $.50 for handling and mailing. Price of the complete set is $110, plus $5.50 in mailing charges. Congress members may obtain the volumes at $7.50 per copy, or $70 for a complete set.

New Phthalic Anhydride Catalyst

Scientific Design Co. Inc. has introduced a versatile new catalyst for phthalic anhydride processing. To the producer using a fixed bed process, the new catalyst permits the utilization at high yield of either naphthalene or ortho-xylene, and also mixtures of the two, depending upon availability and price.

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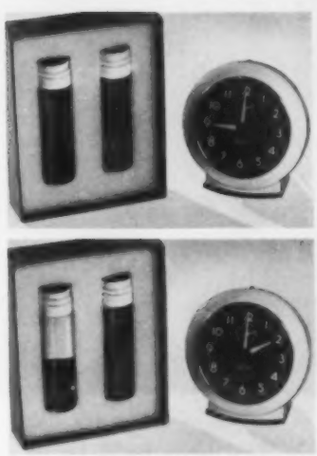

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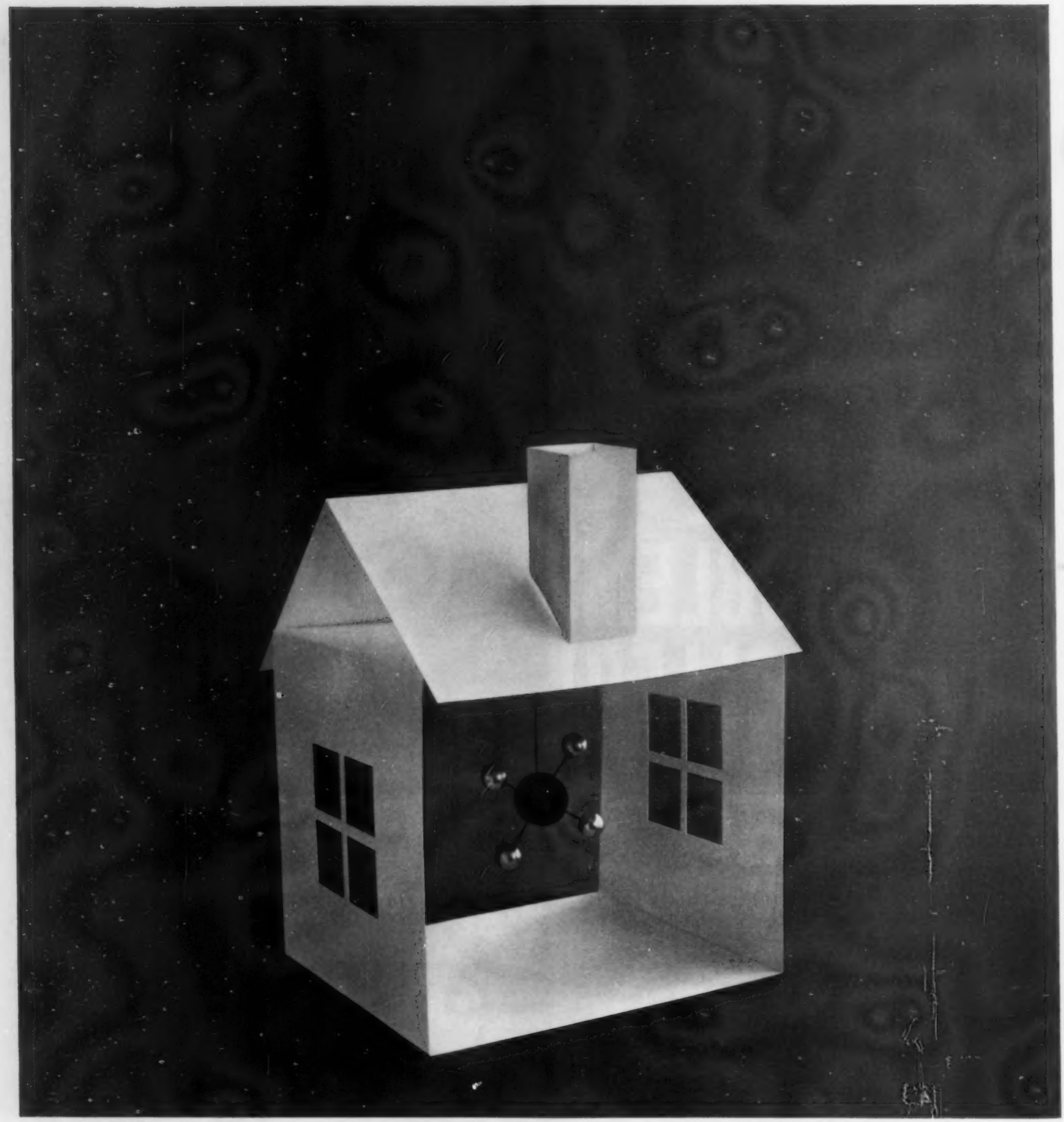

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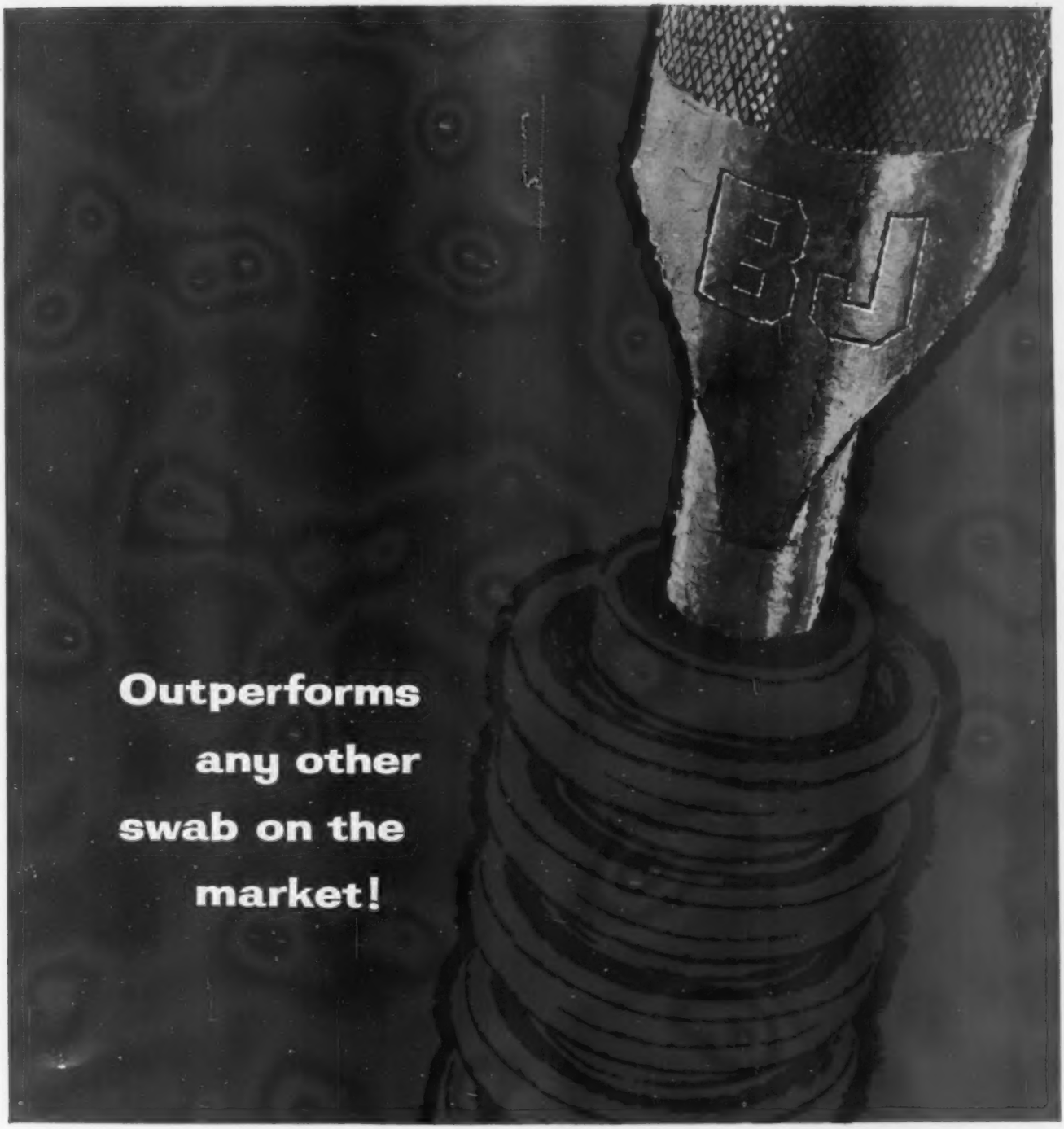

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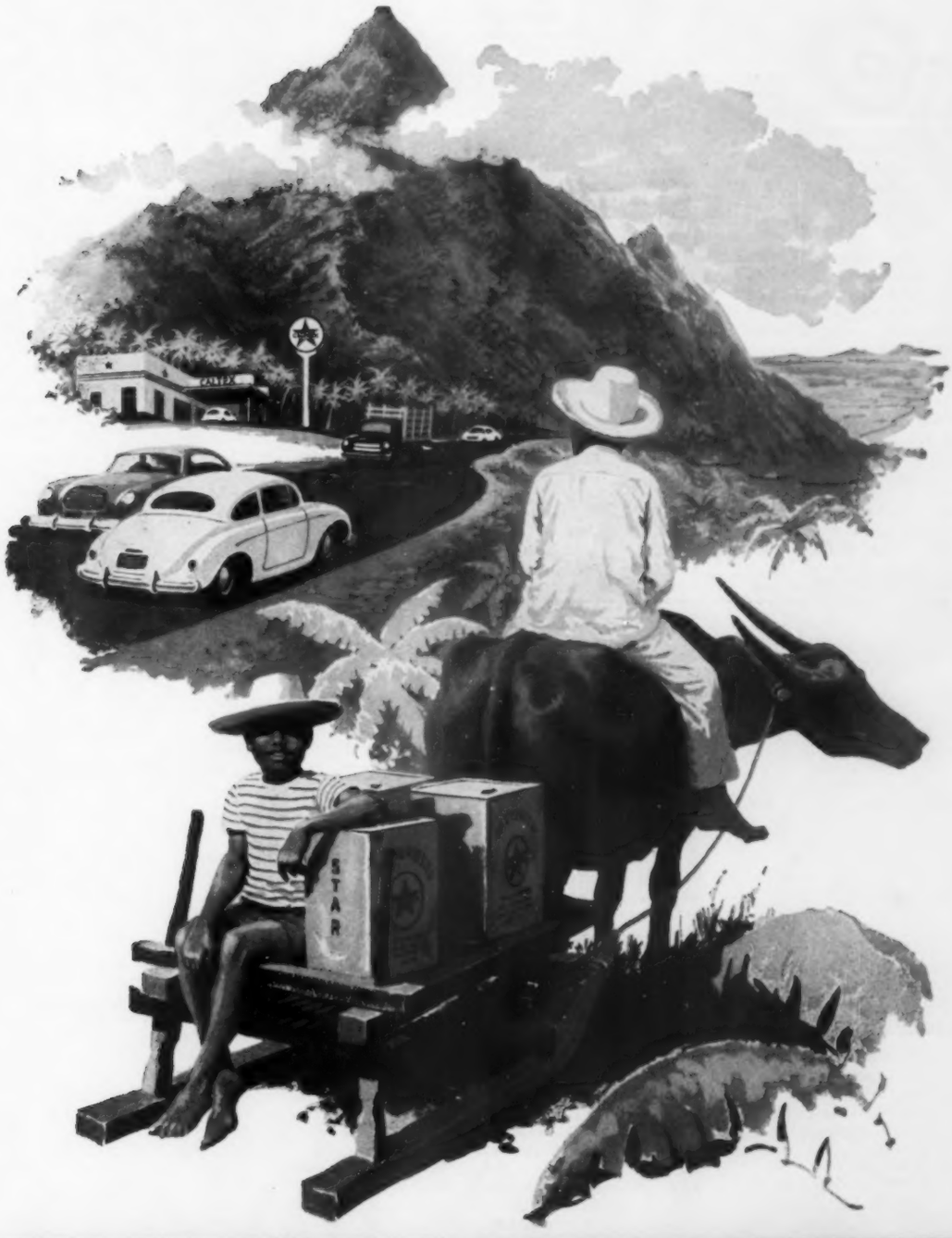

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LATIN AMERICAN OIL NEWS

Argentina—Total crude-oil production in Argentina in the first two months of 1960 was 1,317,405 cubic meters, about 138,000 b/d, some 19.6% ahead of a year earlier. Imports of crude and of products were 870,794 meters about 55% of the level a year earlier Sales of major products came to 2,014,743 cubic meters, up 9% from a year earlier, but 2.7% below two years earlier. YPF said that crude production was 161,000 b/d on April 4, a new record.

The new crude line from Campo Duran to the San Lorenzo refinery has been carrying 15,100 b/d, and will handle 50,000 b/d when pumping stations permit capacity operation.

Argentina—YPF (Argentina's State oil agency) plans to drill more wells in Rio Negro province, after its successful producer near the border of Oatriel Oesta with La Pampa province. YPF reports gas was struck at 80 meters and oil at 280 meters in this, its second Rio Negro well, and in the first 80 hours the well produced 100 cubic meters of oil. YPF's first Rio Negro well struck gas, but was abandoned.

Argentina—Pan American Oil Co. expects to double its production this summer with the completion of a 135-kilometer pipeline from Sarmiento to a loading dock 15 kilometers north of Commodoro Rivadavia in Argentina. Production was 39,273 cubic meters (one cubic meter equals 6.3 barrels) in March, before the line went into service. With the line, Argentina production in April rose to a record of 697,939 cubic meters, some 61,983 cubic meters ahead of March and 194,368 cubic meters ahead of April a year earlier. The April to April gain was 38.6%.

YPF accounted for 565,487 cubic meters of the April output, and private companies under contract to YPF for 132,452 cubic meters.

Brazil—Refinaria e Exploracao de Petroles Uniao, S.A., at Capuava, Brazil, one of the few privately owned refineries in the country, stepped up its output by 12% in 1959. The increase was 1,160,634 bbl of total crude runs.

Products sold last year came to: gasoline, 917,723,-029 liters; fuel oil, 551,742,853 kilos; propane and butane, 61,741,431 kilos.

With fixed assets of Cr. $2.4 billion, a gain of Cr. $538 million in a year, the company paid taxes of Cr. $249 million and gave Cr. $275 million to the government's exploration fund. Net profit last year was Cr. $783 million.

Brazil—Crude production in May in Brazil was an estimated 2,480,000 bbl (80,000 b/d). Rigs operating May: 62. A new oil field has been discovered in Bahia, 3.6 miles from Alagoinhas. First well yielded 60 bbl in 30 min. Several tests are planned in neighborhood .

Petrobas will in future pay royalties to municipalities in which offshore wells exist. There are 114 offshore wells in All Saints Bay, 70% located in municipalities of Sao Francisco do Conde, Santo Amaro, and Salvador; others on Itaparica Island. Staff and equipment are being transferred to Tucano Valley, Bahia, where exploration is starting.

Between January-March 1960 footage drilled totaled 258,586 ft against 174,177 in first quarter of 1959; number of wells drilled 59 this year, against 50 in 1959.

"President Washington Luis," the last of the four 33,000-ton tankers ordered from Verolme United Shipyards, of Holland, arrived at Rio in April. "Presidente Deodoro," 34,000 dwt, was delivered to Petrobras at the Nippon Kokan yards at Yokohama, Japan, in April.

The president of Petrobras, referring to drilling for oil by private enterprise on the Tuncum River (Municipality of Sao Pedro, Sao Paulo) said the Petrobras law does not authorize research by private individuals and those doing so will act for their own account and risk. If they find oil and Petrobras decides to exploit the occurrence, it will pay no indemnity, but merely expropriate the land.

Imports of crude and refined products cost Brazil $281.3 million in 1958, $253.8 million in 1959. Exports of crude and fuel oil earned $28.8 million in 1958, $32.9 million in 1959. Petrobras' activities effected a saving on exchange of $124.8 million in 1958, $143.5 million in 1959.

BRAZILIAN PRODUCTION AND CONSUMPTION OF REFINED PRODUCTS
January to November, 1959

	(Barrels)		
	Production	Consumption	% Domestic Production
LPGas	2,188,502	2,999,739	73.0
Aviation gasoline	—	2,565,486	—
Motor gasoline	17,609,607	22,438,686	78.5
Kerosine	2,099,506	3,602,916	56.3
Jet fuel	—	211,837	—
Diesel oil	6,045,176	15,593,215	38.8
Fuel oil	19,381,073	26,298,545	73.7
Lubricants	—	1,222,484	—
Asphalt	1,000,200	1,017,191	98.3
Solvent	685,520	643,236	106.6
Total	49,009,584	76,593,335	

All shares in Companhia Brasileira de Petroleo Ipiranga have been bought by Refinaria de Petroleo Ipiranga SA, assisted financially by Alberto Soares de Sampaio (president of Refinaria Uniao). Cia, Brasileira de Petroleo Ipiranga is now the first enterprise, formed exclusively with Brazilian capital, authorized to distribute oil products throughout Brazil. The capital has been raised from 300 to 900 million cruzeiros.

Petrobras has refused the samples of the 4,000,000 bbl of crude petroleum offered by Russia in exchange for Brazilian coffee. The oil is reported to be below international standards, with a high percentage of salt (22.2%) and containing sulfur. The Russian trade mission has returned to Moscow, promising to send other samples. Their chief said: "We produce 130 million barrels and export 15 million; the type required by Brazil is, therefore, certain to be available."

The first consignment of 100,000 tons of diesel oil ordered by Brazil is now in transit from Russia.

The manager of Ranpat International Corp., with headquarters at Montevideo, has been in Brazil negotiating the purchase of Brazilian coffee for the soluble coffee industry in exchange for petroleum. The origin of the latter is not disclosed, but it is guaranteed to be of first quality.

Argentina and Russia have signed a protocol to the 1958 agreement relating to the $100 million credit, granted by Russia for the purchase of oil-industry equipment. The protocol authorizes Argentina to utilize the balance of the credit, amounting to $50 million, for the purchase of any other equipment required for industrial development.

British Honduras—Esso has decided to build an oil storage terminal at Belize, British Honduras, and hopes to have it in operation by the end of this year. It will consist of a permanent mooring 4,000 ft offshore with an underwater line to a 30,500-bbl tank farm for 12,500 bbl of motor gasoline, 4,000 bbl of aviation gasoline, 8,000 bbl of diesel oil, and 6,000 bbl of kerosine. The tank farm will be about two miles south of Belize in Sibun Bight. The facility will accommodate deep-water tankers. Now, a barge carries oil products from Tela to a small storage facility five miles up the Belize River. The barge and tug are owned by Esso, but the storage facility by Shell. In the future, tankers will unload part of the product at Tela and the rest at Belize. Shell will be hurt by the new terminal, it is said. The government has only two dredgers to put in the three ft of fill needed, and they are in use for housing projects.

British West Indies—An exploration license has been granted Harry T. McClain of Houston, Texas, and E. D. Merren (West Indian businessman) for Grand Cayman Island. The first four tests is to be started soon on the northwest side of the island, which is 180 miles northwest of the island of Jamaica.

Mexico—Pemex has announced that the sale of Venezuelan gasoline has begun in the Mexican state of Lower California, and it is cheaper than that formerly imported from the USA. Mexico is acquiring the gasoline in an exchange deal for Mexican oil products, mainly fuel oil. The Venezuelan gasoline will be shipped from Aruba via the Panama Canal.

Mexico—Edwin P. Pauley, president of Pauley Petroleum Inc., Los Angeles, plans "substantial expenditures" this year and next in drilling in Mexico and in the tidelands leases off California. This was explained in a statement seeking to register $10 million of convertible debentures, due 1976, with the Securities and Exchange Commission. Of the net proceeds, $7 million will go to pay bank borrowings for the company's Mexican tidelands operation and to reduce current liabilities, the SEC was told. The balance will go to general funds.

Edwin P. Pauley owns 51% of the common stock, of which 1,945,393 shares are outstanding. The company operates a refinery and explores for and develops oil and gas.

Paraguay—Consumption of oil products in Paraguay last year was 100,758,000 liters (160,188 bbls.) Product imports were 114,812,000 liters. Stocks rose from 19,078,000 liters at the start of the year to 32,202,000 liters at the close. Gasoline consumption was 39,977,000 liters, and kerosine came to 15,249,-000 liters. Fuel-oil consumption was 26,211,000 liters.

Peru—Fifty-two wells were drilled in Peru during 1959—49 development and three wildcats. All three wildcats found oil—one by Empresa Petrolera Fiscal; one by International Petroleum Co. Ltd.; and one by Cia. Petrolera Lobitos.

Forty-three of the developments wells found oil, and six were dry holes. Empresa drilled 18, of which 17 found oil, and one was dry. International drilled 15, including three secondary wells, and 12.5 found oil and 2.5 were dry. Petrolera Amotape SA drilled eight, of which six were oil and two dry. Cia. Petrolera Lobitos drilled seven, of which 6.5 found oil and 0.5 were dry. Cia. Peruana de Petroleo 'El Oriente' drilled one dry well. The development figures correct an earlier report.

Peru—Belco Petroleum Corp. has completed an offshore well in Peru which flowed at an initial rate of over 1,100 barrels of oil per day. Called Litoral 4/2, it is the third successful well Belco has drilled on its offshore concessions of over 10,000 acres, located off the northwest coast of Peru. All these wells have been slant drilled out under the ocean from locations on the beach.

In drilling the Litoral 4/2 well, two producing horizons were encountered totaling 283 feet in thickness. The Parinas, or upper formation, was reached at a vertical depth of 1,200 feet, and the lower Salinas formation at a vertical depth of 2,000 feet.

Belco's principal business is the production and sale of natural gas in the Rocky Mountain area. Belco Petroleum Corp. is the largest natural gas producer in the state of Wyoming and over 75% of its revenues are derived from the sale of natural gas under long-term contracts.

Trinidad—The new 100,000 b/d Texaco refinery at Port of Spain, Trinidad, is expected to contribute $35 million a year net to gross domestic product for the country—based on a cost of $27.97 a ton of Middle East crudes, c.i.f., and export product prices of $37.64 a ton, or a refinery margin of $9.67 per ton. The crude price is adjusted upward to allow for a 7% refinery loss. On the basis of 12-month operation, production would be 4,867,000 tons yearly (under 98,000 b/d) and a net addition of $47 million, but actual operation will be for only nine months. During 1959, CIF cost of Saudi Arabian crude at Trinidad was $26.14 per ton, while that of Venezuelan oil was $28.36 (figures adjusted for refinery losses).

Uruguay—Uruguay imported 8,300,000 bbl of crude oil last year. Some 5,881,000 bbl came from Venezuela; 2,289,000 from the Soviet Union, and 130,000 from Netherlands West Indies. Uruguay also imported 2,673,000 bbl of lubricating oil, of which 1,281,000 was from the USA, and the rest from Italy, NWI, France, Argentina, England, and Holland.

Imports of fuel oil amounted to 1,643,000 bbl of fuel oil; 696,000 from the Soviet Union, 454,000 bbl from NWI, 390,000 from Venezuela, and 103,000 bbl from Brazil. Gas-oil imports were 582,000 from the Soviet Union and 57,000 from NWI. Diesel oil imports were: 101,000 from NWI and 32,000 from Venezuela. Motor-fuel imports were 113,000; 86,000 bbl from Soviet Union and 27,000 from Argentina.

Uruguay imported 92,000 bbl of lubricating greases; 52,000 from the United States, 36,000 from England, and 4,000 from France. Kerosine imports were 72,000 bbl, all from USSR. Avgas imports were 56,000 bbl, all from NWI.

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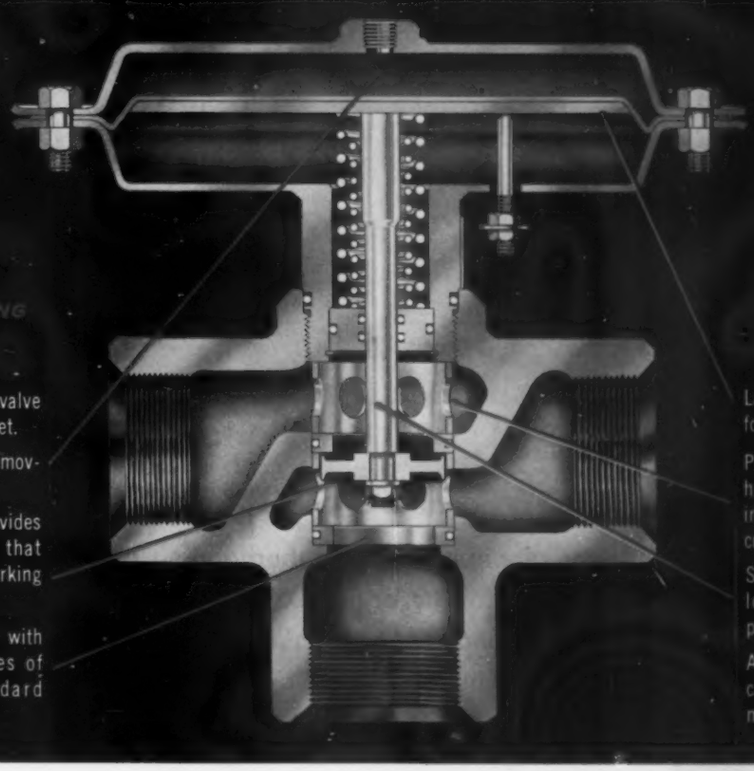

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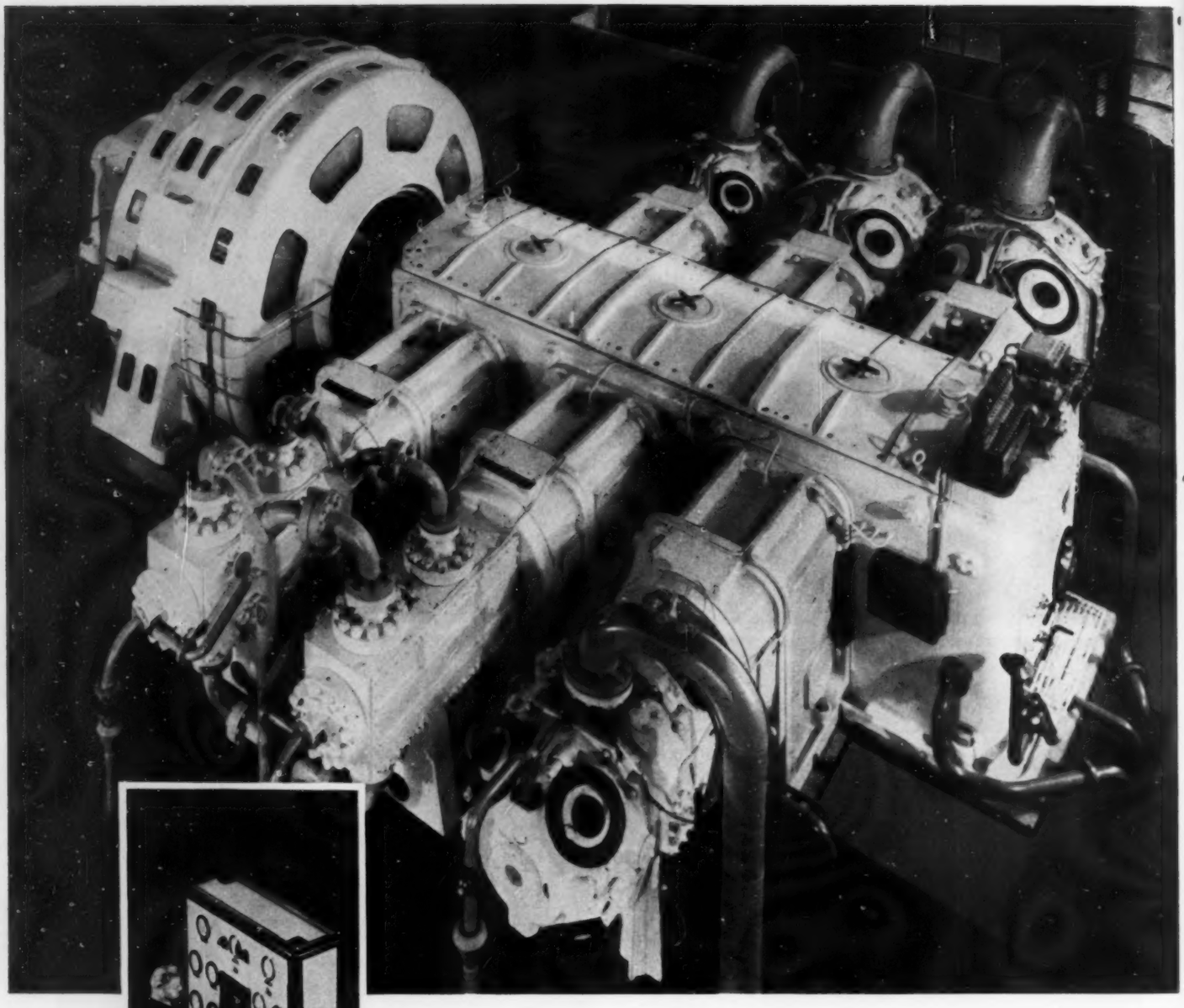

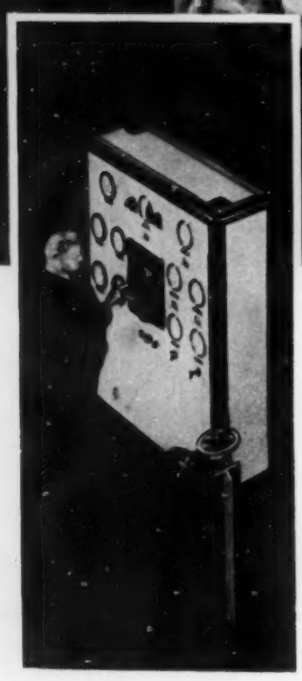

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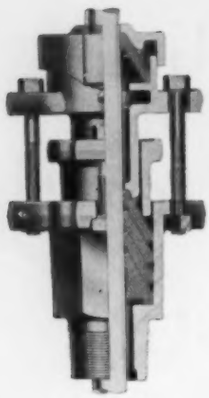
Provide the ultimate in SAFETY, ECONOMY and EASE of operation

Hercules Stuffing Boxes — like all Hercules Products — are improved constantly to meet the changing needs of the industry and are available in three styles. They are used internationally and are available through supply houses, everywhere.

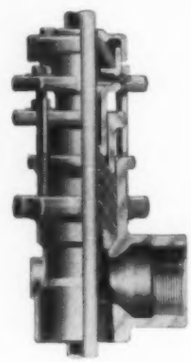


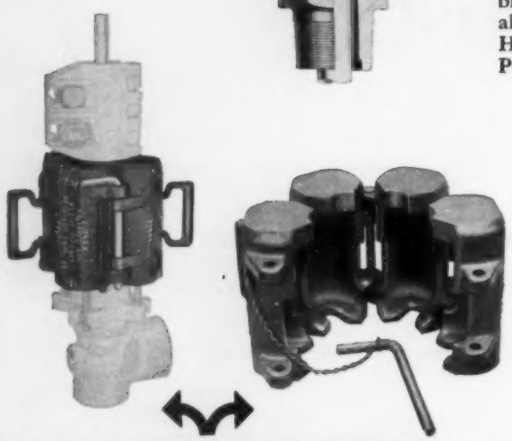
HERCULES REGULAR TYPE DUPLEX STUFFING BOX

More efficient operation with fine adjustment possible. Offers longer packing life due to ability of Packing and Glands to follow lateral movement of Polished Rod. Malleable iron construction prevents breakage if rods are accidentally dropped on Stuffing Box. Has male thread to screw into Pumping Tee.

HERCULES TEE TYPE DUPLEX STUFFING BOX

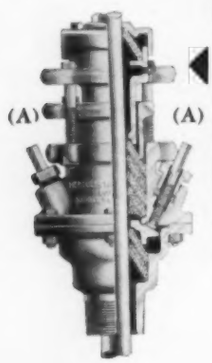
A combination Tee and Stuffing Box only 15" high. Eliminates one threaded connection between Stuffing Box and Tee. Full opening — allows rods to be run or pulled without removing Stuffing Box body. Has female thread to screw directly onto tubing.





HERCULES POLISHED ROD CLAMP-OFF SUPPORT

Used with Hercules Regular and Tee Type Stuffing Boxes to *prevent accidents* or personal injuries while clamping off. Manufactured from high tensile aluminum alloy, will safely support 30,000 lbs. weight.



HERCULES TYPE DP (Double Packed)

Duplex Stuffing Box for use on high pressure or intermittently flowing wells. Allows Main (upper) Packing to be safely and easily replaced while well is under pressure. The two compression bolts (A) are turned clockwise until the lower Packing seals off. The Main Packing can then be removed and replaced.

HERCULES OIL RESERVOIR GLAND

All Hercules Stuffing Boxes may be equipped with *Oil Reservoir Upper Gland* on *problem* wells which pump off and burn packing. The polished rod runs through the Reservoir, and is cooled and lubricated by its fluid.

For Best Results in Hercules Stuffing Boxes, use only

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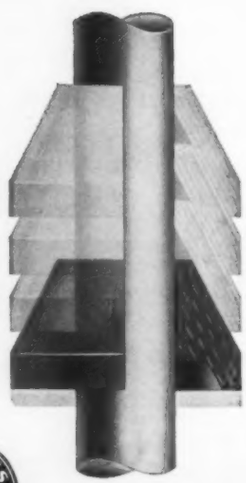
Each set of Hercules Cone-Shaped Packing Rings now include the NEW, SOLID Split Bottom Cone Packing Ring. This new solid ring provides greater contact with the polished rod and a more substantial base for the upper Packing Rings, resulting in *longer* packing life and superior performance. A complete set now consists of three *regular* and one new split *Bottom Cone* Ring.



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Hercules Split Cone Packing Rings come in four grades: SOFT, HARD, SPECIAL LUBRICATED and HEAVY DUTY. SOFT Rings are always used with bronze liners or with steel polished rods in wells which are not always pumping fluid. HARD Rings are recommended for steel polished rods only, and where fluid is constantly being pumped. SPECIAL LUBRICATED Rings are recommended for problem wells which pump off persistently. When well is pumped dry, the rings lubricate the polished rod and prevent the packing from burning until fluid is again present. HEAVY DUTY Rings are recommended for problem wells. Properly adjusted, they give phenomenal life.

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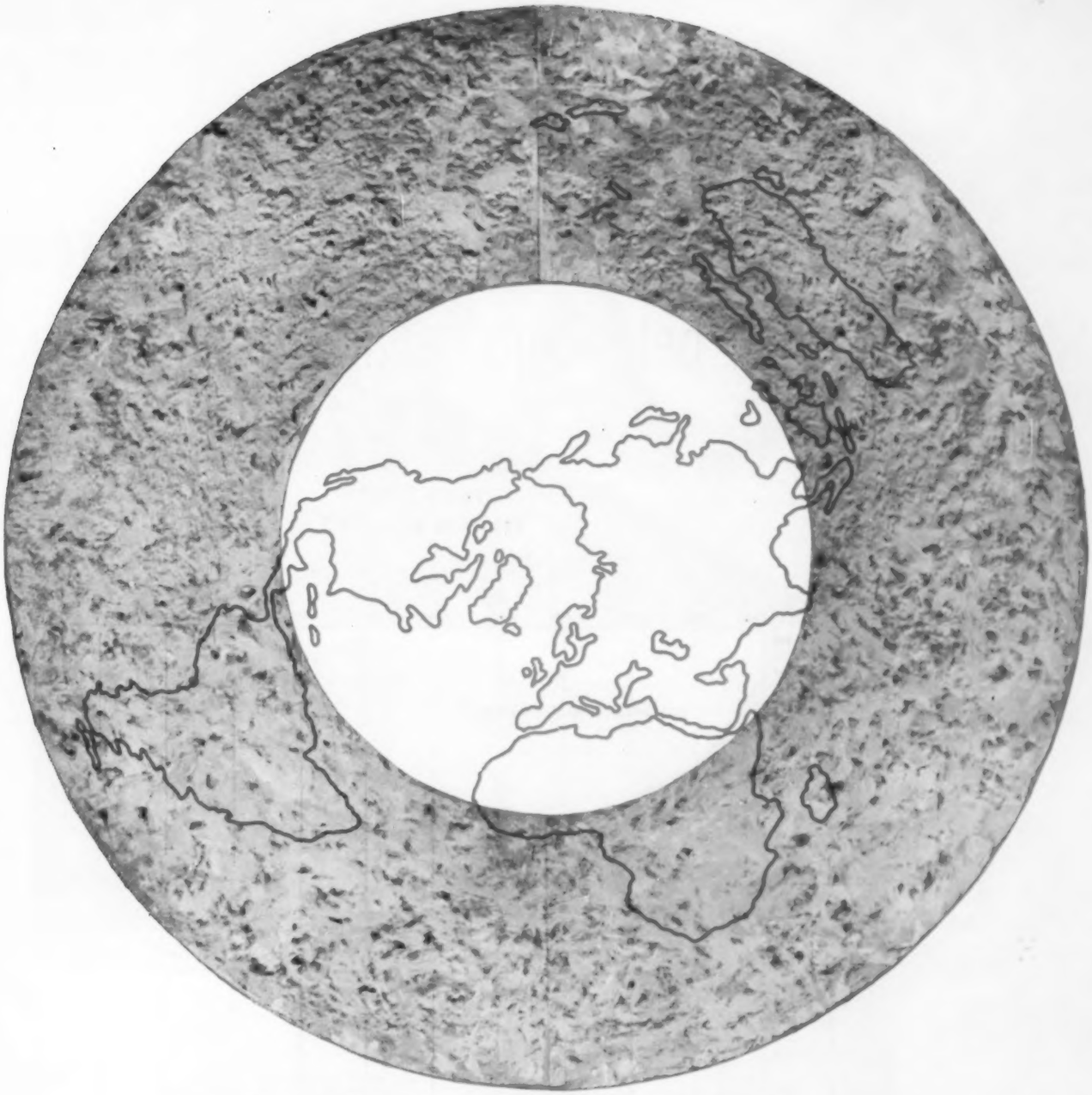

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Italy	by Capamianto SpA
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Spain	by Messrs. Eduardo Rosa
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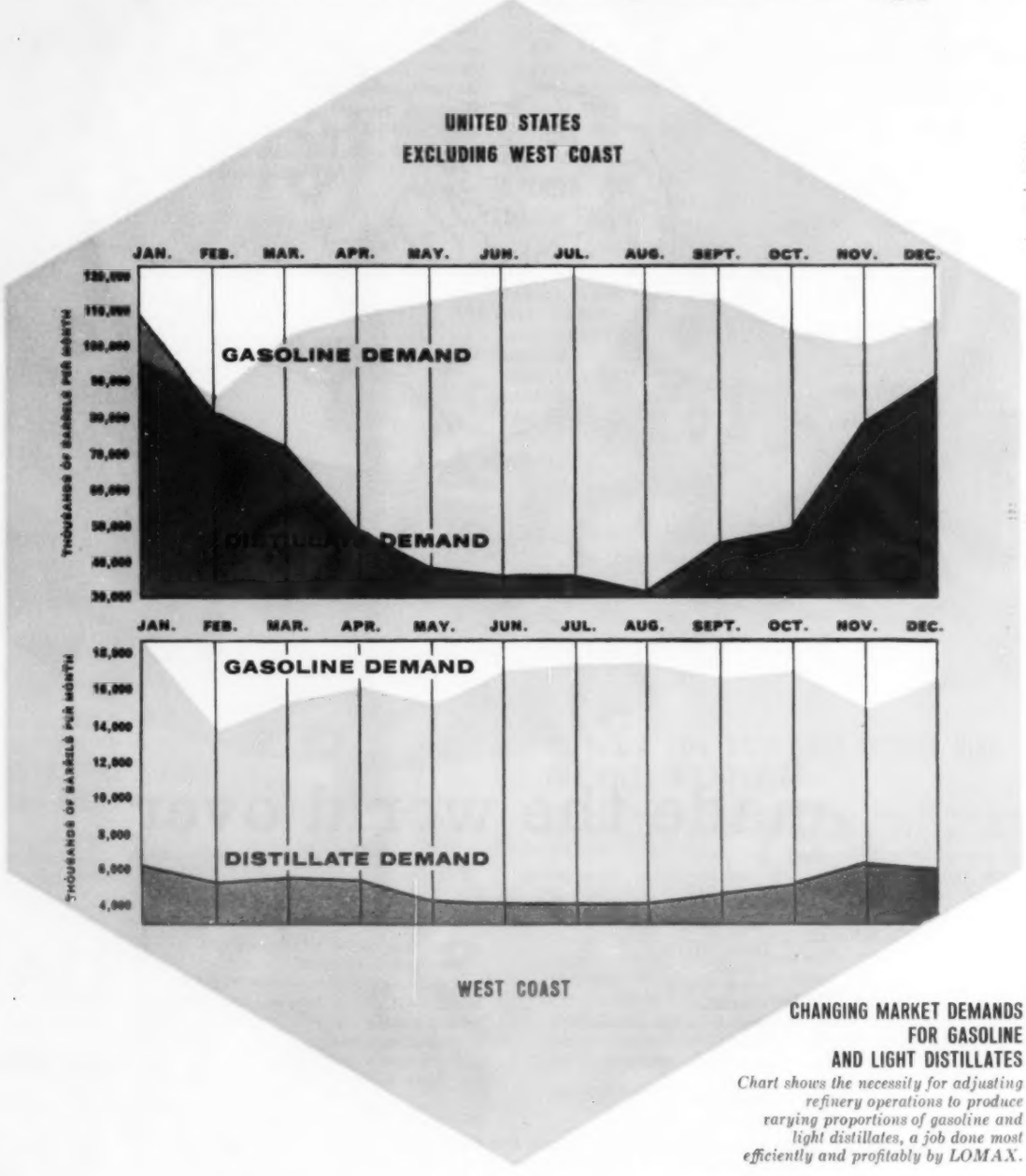
UNITED STATES
EXCLUDING WEST COAST
JAN. FEB. MAR. APR. MAY. JUN. JUL. AUG. SEPT. OCT. NOV. DEC.
GASOLINE DEMAND
DEMAND
JAN. FEB. MAR. APR. MAY. JUN. JUL. AUG. SEPT. OCT. NOV. DEC.
GASOLINE DEMAND
DISTILLATE DEMAND
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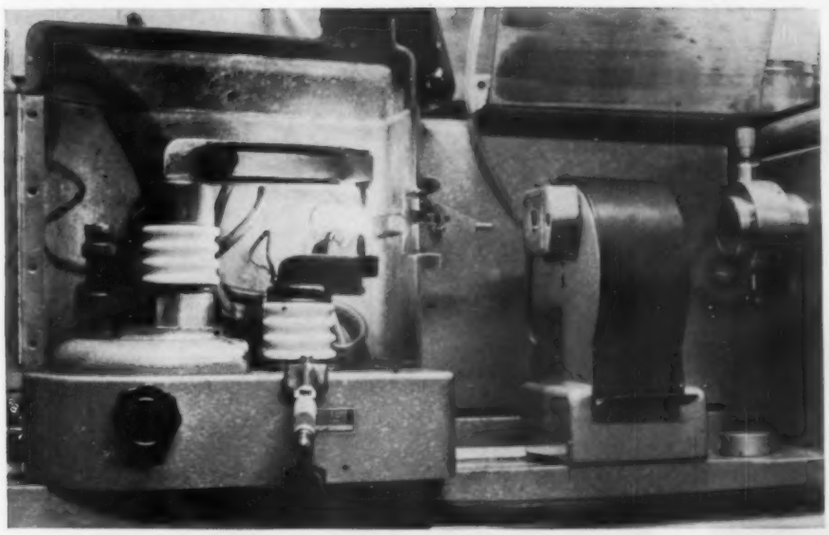
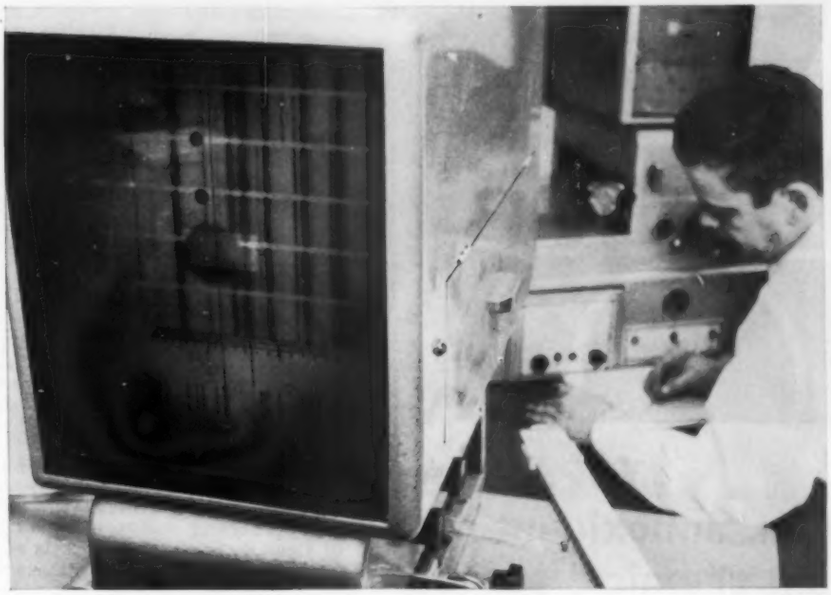


Emission Spectrograph (above) causes undesirable elements in a petroleum sample to emit their characteristic light spectrum which is photographed on a strip of film. In the Densitometer (below) the spectrum on the film is evaluated to identify the presence of metal contaminants down to less than one part per million.



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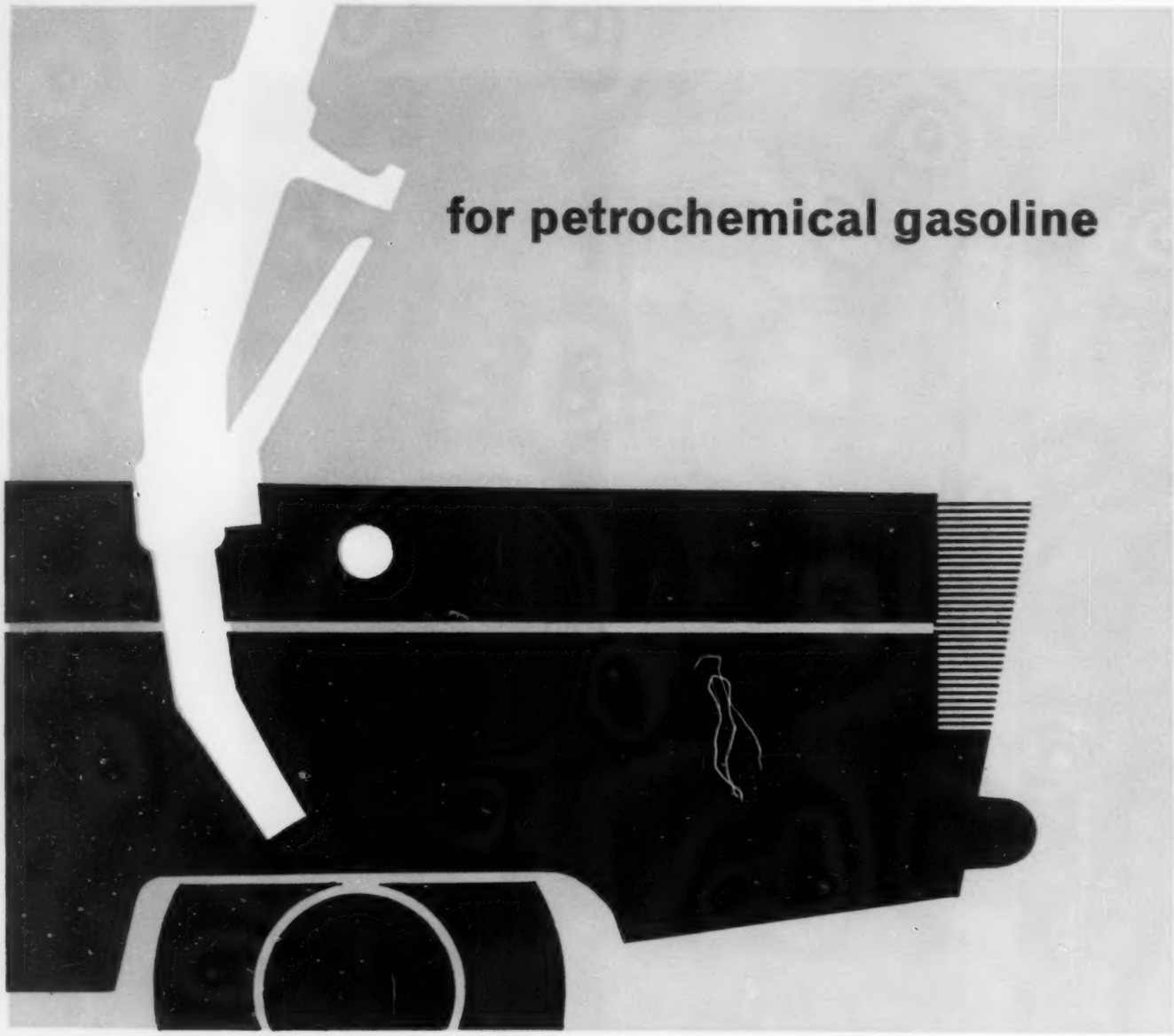

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The efficiency of high-temperature petroleum cracking plants manufacturing primary chemical 'building-blocks', such as ethylene, propylene and butylenes, is not at its best unless maximum use is made of the liquid hydrocarbon fractions which occur as by-products. These fractions are notoriously unstable, but can be converted into valuable gasoline if the right type of antioxidant is employed. This is the function of 'Topanol' AN, which is expressly designed to produce marketable gasoline of good quality at low cost.

'Topanol' AN is one of a range of I.C.I. antioxidants for practical and inexpensive treatment of gasolines and hydrocarbon liquids.

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Do you know the answer to this question?

Q. Which is taxed at a higher rate—

a fur coat? OR gasoline?

A. The tax rate on gasoline is almost 5 times as high!

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Q. What's the average federal and state tax on ten gallons of gasoline?

A. About <u>one dollar</u>!

Q. How much have gasoline taxes increased in the last ten years?

A. About <u>51%</u>! (But the price of gasoline itself has only increased 5.5%!)

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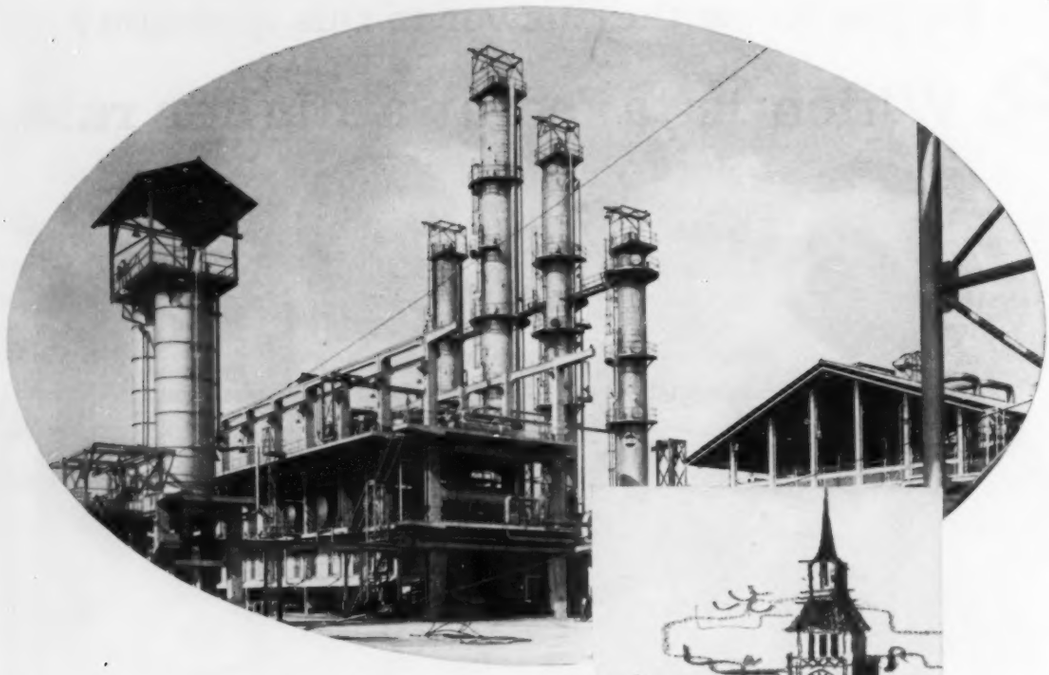

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NEWS ON TEXACO PROGRESS

A long way from curb service a la cart

YESTERDAY — Back at the turn of the century, when automobiles were jeered as well as cheered, gasoline was dispensed by hand. It was poured from a measuring can into the tank through a chamois-screened funnel. Remember? Later, it was hand-pumped into a glass bowl on top and flowed by gravity down through the hose.

TODAY — modern service stations have automatic, meter-computing pumps. Texaco alone has over 38,000 stations in the U.S.A. They are manned by skilled Texaco Dealers, offering quality Texaco products. Aided by research and the most modern refining and transportation techniques, Texaco has become one of America's leading petroleum marketers.

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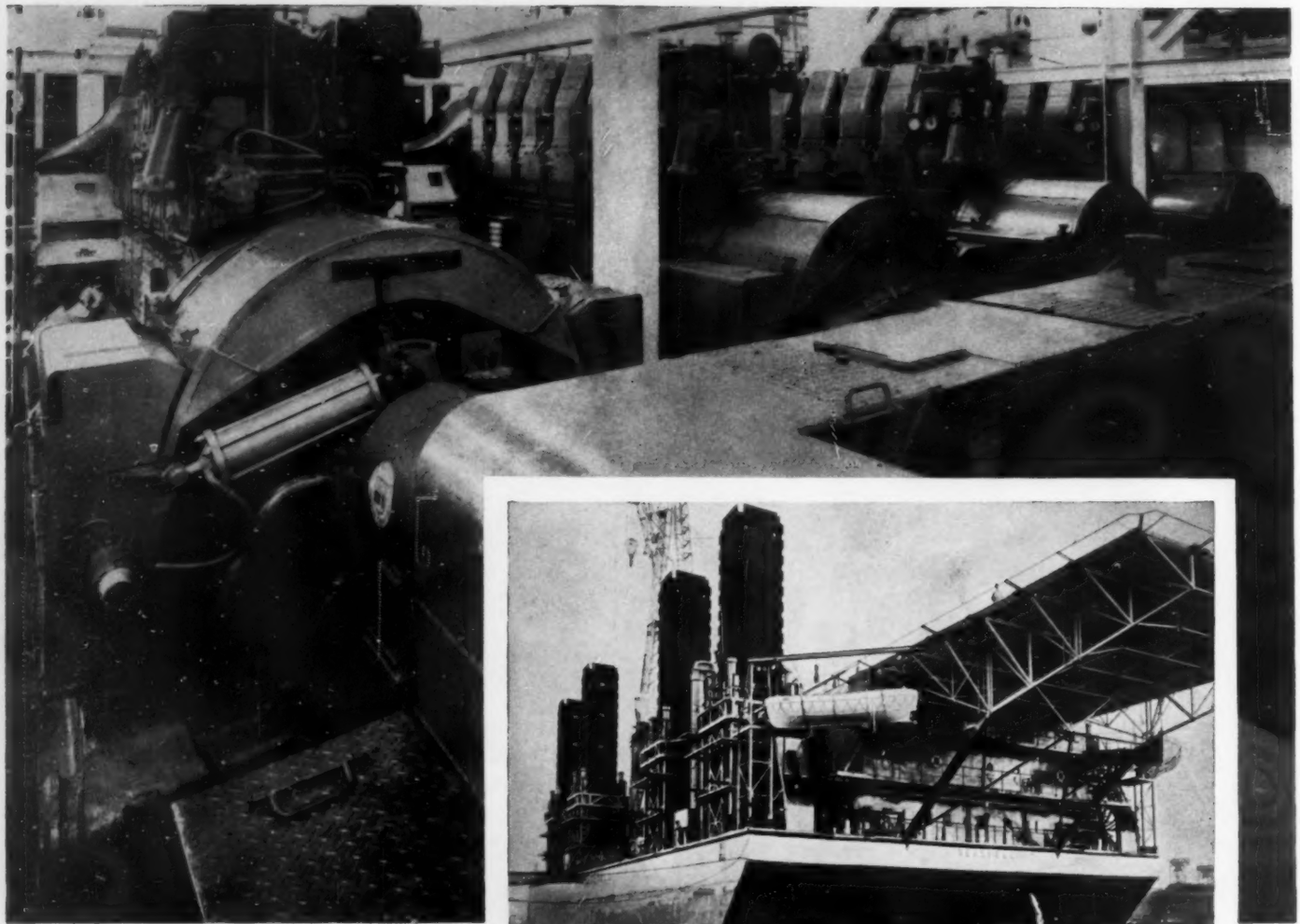

Diesel power for "SEASHELL"

OIL DRILLING IN THE PERSIAN GULF

The main power needs of 'SEASHELL', a mobile oil-drilling platform barge of Bataafsche International Petroleum Maatschappij operating in Doha Bay, Qatar, are provided by six 'ENGLISH ELECTRIC' diesel engines.

The four illustrated are six-cylinder pressure charged, charge-cooled engines, with a continuous site rating of 795 b.h.p. at 900 r.p.m. Two of these engines drive the draw-works and rotary table through 'ENGLISH ELECTRIC' 500 kW generators and 650 h.p. motors. Surplus power can be used by means of splined clutches to supplement the power of the other two engines driving the slush pumps.

Another two engines developing 470 b.h.p. at 900 r.p.m. are coupled to 326 kW alternators providing the normal power supply of the barge itself.

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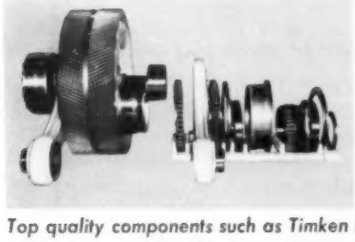
These all-steel pumps feature precision-built power ends and streamlined one-piece fluid ends which work together as a tough team to help you show more profit in today's competitive market.

Ideco pumps are a product of the application of years of engineering experience by men who really know pumps. Fabricated all-steel design assures minimum vibration . . . heat treated pinion shaft and Falk herringbone main gear can be reversed for double life . . . double-row Timken tapered roller bearings assure durability. Threaded valve pot covers speed valve servicing and reduce crew work. Gamma ray and strain gauge tests prove the strength of every part.

So remember, when you think of mud pumps . . . think of Ideco — you'll get the best. Just ask the men who have been using them.



Top quality components such as Timken bearings and Falk herringbone gears assure longer, trouble-free performance. Streamlined, one-piece cast steel fluid ends are designed for highest volumetric efficiency and tested to twice rated operating pressures. Fabriform frames are stronger and lighter in weight.

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These are the Halliburton men you never see on a cementing job — or fracturing — or testing — or any job taking place at the well site . . . *but none of these jobs could be done without them.*

They are the machinists, foremen, inspectors, helpers, assemblymen in the Halliburton plants and field mechanics on duty in each of Halliburton's 275 Service Centers and Stocking Points dotting the oilfields of the world.

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Dependable equipment can only result from dependable people. We're glad to have them!

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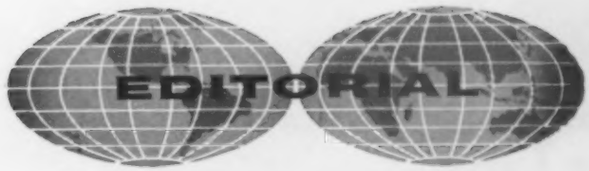


A Bleak Economic Future

Revolutionary leaders who rescue their people from dictatorship and oppression usually are men who are not trained in the sciences of government or economics. Result is that they may permit civil discipline to deteriorate, countenance excesses of the rabble and make mistakes which seriously damage the well being of the people they have sought to aid. Cuba is a prime example of a country in which leaders have made decisions in the field of economics which have destroyed the confidence of investors and created a situation from which Cuba cannot hope to recover in the forseeable future.

Beginning with land reforms and extending rapidly into other areas the Castro government has step-by-step taken the property of its own citizens as well as of foreign investors without payment or with only token payment in bonds of doubtful value. It was a serious miscalculation to assume that the Cuban economy could be changed overnight from a dependence on sugar to that of other and diverse crops. Such shifts require years of experimentation and market development to accomplish.

The nearby island of Puerto Rico has been revolutionizing its economy, but has been doing so gradually and by encouraging outside investors to create jobs for its people as well as through crop diversification.

Castro's latest error of judgment is one which bids fair to be most costly since it endangers all or much of the subsidy which the USA has been pouring into Cuba for many years. To soften up the oil companies Castro first froze their income from the sale of products in Cuba. The companies were permitted to import their own or purchased crude but were not allowed to pay for it. His next step was to purchase cut-price Russian crude and demand that USA and British refineries displace half their own crude with this oil. The demand was directly contrary to the agreements under which the foreign companies invested many millions in new and modern plants and gave employment to hundreds of Cuban nationals. Cuba, of course, holds that its 1938 law requiring the oil companies to process government crude covers the situation. This is contrary to oil industry practice under which companies have been willing to refine government royalty oil—not oil purchased from foreign firms or governments.

Castro says he can buy the Russian crude at a dollar per barrel below the price being paid by Texaco, Shell and Esso. This is quite true. Crude markets are soft and distress crude is available at cut prices from non-Soviet sources. The Russian price, however, may be considered as having been made for political reasons rather than because that nation needs the market.

Cuba needs about 65,000 barrels of crude per day which means that the nation hopes to reduce its dollar requirements by about $24 million per year.

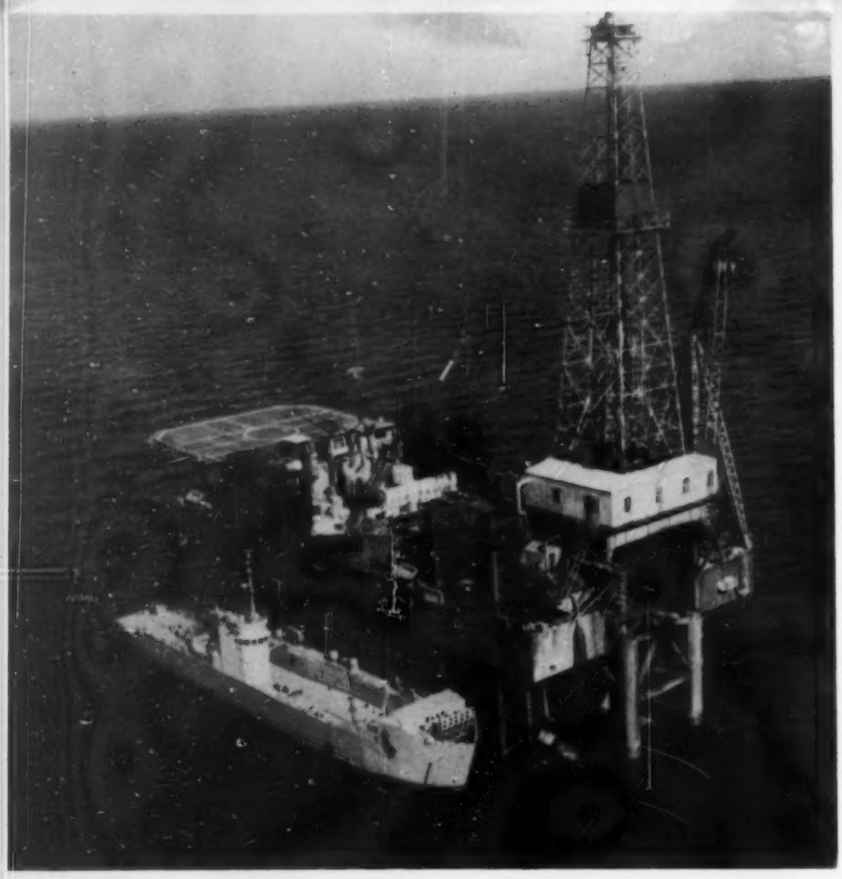
On the other hand the government of the USA has allowed Cuba a quota of over three million tons of sugar and has been paying a premium of two cents per pound over the world market. Cuban foreign exchange thus gained about $150 million last year through the sugar subsidy. In passing it may be noted that Russia did not meet the USA sugar price but paid two cents per pound less than the USA in the crude oil exchange.

What Castro has done is to gain $24 million per year through the purchase of cut price oil at the cost of up to $150 million in sugar subsidies—assuming that the government is unwilling to permit Cuban authorities to confiscate $1,000 million in USA properties and continue paying five cents per pound for sugar which can be bought for three cents in world markets. The prospective loss to Cuba is thus about $125 million per year.

There is another aspect to the affair which should give Cuba much concern. The USSR will expect to be paid for its oil and since Cuba has little except sugar to export it will have to pay largely in that commodity. This will give Russia a tremendous volume of sugar to sell or use—a lot more than the red bloc can stir into its tea. The USSR thus will become a seller of sugar on balance and who is to say that the Soviets will support the sugar markets any more than they will support the crude oil market. This is indicated by what has been happening in recent sugar trading. Instead of getting three cents for his sugar exports Castro can very well net a much lower figure when Russia starts to dump its unusable surplus. She has broken other commodity markets in the past.

Ten years ago the USA had an investment of about $642 million in Cuba. This now has risen to about $1,000 million. In addition, Cuba has been supporting its economy by blocking foreign remittances for goods, services, patent rights etc. The Cuban government places the amount at $100 to $125 million but USA government figures are on the order of $150 to $200 million. Large amounts also are due British-Dutch interests.

Under international law Cuba may expropriate the properties of foreigners if prompt and full payment is made. Thus far there is no suggestion that Castro expects to meet either of these requirements. In view of this there is little likelihood that Cuba can expect an inflow of capital from other countries. Since she does not have surplus savings on which to draw, the economic future of Cuba is bleak indeed.



Air view of Pan American's offshore mobile drilling platform and tender.

Pan American is conducting a major exploratory campaign offshore from Iran, using a movable drilling platform with modern equipment and conveniences.

Offshore drilling in Iran

by **J. D. Wells**
Pan American International Oil Corp.

THE SAGA OF IRAN PAN AMERICAN OIL CO.'S Persian Gulf Well, IPAC A-1, began in Orange, Texas, on February 5, 1959. On that date the 4,200 hp tug, "Zwarde Zee," pride of the Smit Towing Co.'s fleet, cleared port with the mobile drilling platform, DeLong 144, in tow.

The 10,800-mile sea voyage to its ultimate destination at Khorramshahr, Iran, on the Karun River, was made without incident as the tow averaged slightly over five knots for the entire trip. Here, the final assembly of the platform legs and loading out of all of the necessary supplies were completed.

In early October, 1959, the platform was again under tow. This time its destination was latitude 29°17'34.10", longitude 49°31'-30.07" where in water 126 ft deep it would be home base for the platform and its crew for the next eight months. On October 12 1959, IPAC spudded its first wildcat well in the waters of the Persian Gulf approximately 53 miles off the eastern shore of the Gulf and 85 miles south of the Company's shore base at Khosrovabad on the Shatt-al-Arab River.

The DeLong 144, which IPAC has on a long term lease from Cia Barca de Panama, a subsidiary of DeLong Corp. of New York City, was fabricated by the American Bridge Division of United States Steel Corp. and outfitted by Levingston Shipyard, both at Orange, Texas. The outfitting for operations in the Gulf of Mexico was nearing completion when arrangements were finalized for its charter for the Persian Gulf operation. A complete review of the design of the platform, its integral equipment and its entire complement of drilling components was immediately undertaken by engineering personnel from IPAC and DeLong Corp.

Prior to acquisition of this platform, IPAC had engaged A. H. Glenn and Associates to prepare a meteorological and oceangraphic survey and Wimpey & Co. to conduct a foundation survey and obtain representative soil borings of the area.

Using the data obtained in the above surveys, it was possible to evaluate the platform design and with these data as a basis to provide maximum safety and comfort for the drilling crews; maximum flexibility and interchangeability of equipment; maximum simplicity and the most fully self-contained mobile which allowable space and prudent engineering would permit.

The DeLong 144 is a self-elevating mobile platform, 200 ft long by 104 ft wide by 15 ft deep. It is equipped with eight steel towers (legs) which were initially 175 ft long by 12 ft square. These were lengthened to 240 ft after reviewing the foundation and oceanographic data in order to provide adequate clearance above the water and still allow sufficient leg length for the estimated penetration into the Gulf bottom.

On location the legs are jacked down through the water and into the Gulf bottom until no further penetration is obtained. The platform is then raised to its opera-

tional level on the legs, the lower 50 ft of which consist of an 11-ft 9-in diameter cylinder with a concave bottom which is so designed to lessen the penetration of the legs into the sea floor. The upper portion of the legs is an open truss of tubular members designed to reduce resistance to wave action and thus minimize loads on the platform due to storms.

The legs are raised and lowered by means of sixteen DeLong hydraulic jacks, two per leg, each with a capacity of 400 tons and which raise or lower the platform at a rate of approximately 16 ft per hour. There are two legs on each corner of the platform which can be controlled individually or in pairs, or all eight can be moved simultaneously. The 3,000-psi hydraulic system which actuates the jacks is made up in four units, one for each corner and each consisting of one Dennison 35 gpm pump driven by a 60 hp motor and the necessary oil reservoir, filters, strainers, valves, control and safety devices. The system is designed to fail safe and is equipped with both hydraulic and electrical interlocks to prevent the jack pins from disengaging and dropping the platform.

The 15-ft deep hull provides facilities for storage of 310 tons of cement and mud, 290 tons of drilling water, 150 tons of salt water, 100 tons of potable water and 200 tons of fuel oil. The hull also houses the entire electric generation plant, salt water evaporator, refrigerator and air conditioning machinery, air compressors, pump room, work shop and laundry room.

The DC electric plant, which supplies power for all of the drilling equipment except one auxiliary mud pump, consists of three 1,000-hp Alco Products diesel engines, each driving two 500 KW General Electric generators. Two of these diesel-driven units can supply the total power requirement of the rig so that one complete standby unit is available for emergencies or for planned maintenance shut downs without jeopardizing the rig operation. Two 438-kva General Electric generators, each driven by a Caterpillar D-397 diesel engine, supply the AC power. One of these units will supply the entire power requirement so a full 100% standby is provided.

Potable water is supplied by a Cleaver-Brooks four-stage waste heat flash-type salt water evaporator. This unit, with a capacity of 1,000 gal/hr, provides an excess of fresh water over the crews' demands. This excess can be used to reduce the salinity of the drilling water and thus effect a considerable savings in the cost of chemicals used in the salt water mud.

A central air-conditioning system for the quarters building, consisting of one 16-ton and one 24-ton Carrier Corporation unit, is located in the pump room. Due to the increased size of the crews' quarters, which will be discussed later, and the high ambient temperatures (130F) in the Persian Gulf area during the summer, these units replaced the installation normally deemed sufficient for operation in the Gulf of Mexico. The refrigeration units for the galley's walk-in cooler and deep freeze are also located in the pump room. The capacity of these units was adequate to take care of the equipment served. However, the air-cooled condensers were replaced with salt water-cooled cupro-nickel condensers because the high temperature anticipated in the pump room would materially reduce the efficiency of the units.

Anticipated temperature effects from both the atmosphere and the 95F cooling water necessitated an investigation of all of the heat exchangers and lube oil coolers on the platform. This equipment was either replaced or supplemented if its derated capacity indicated it was inadequate.

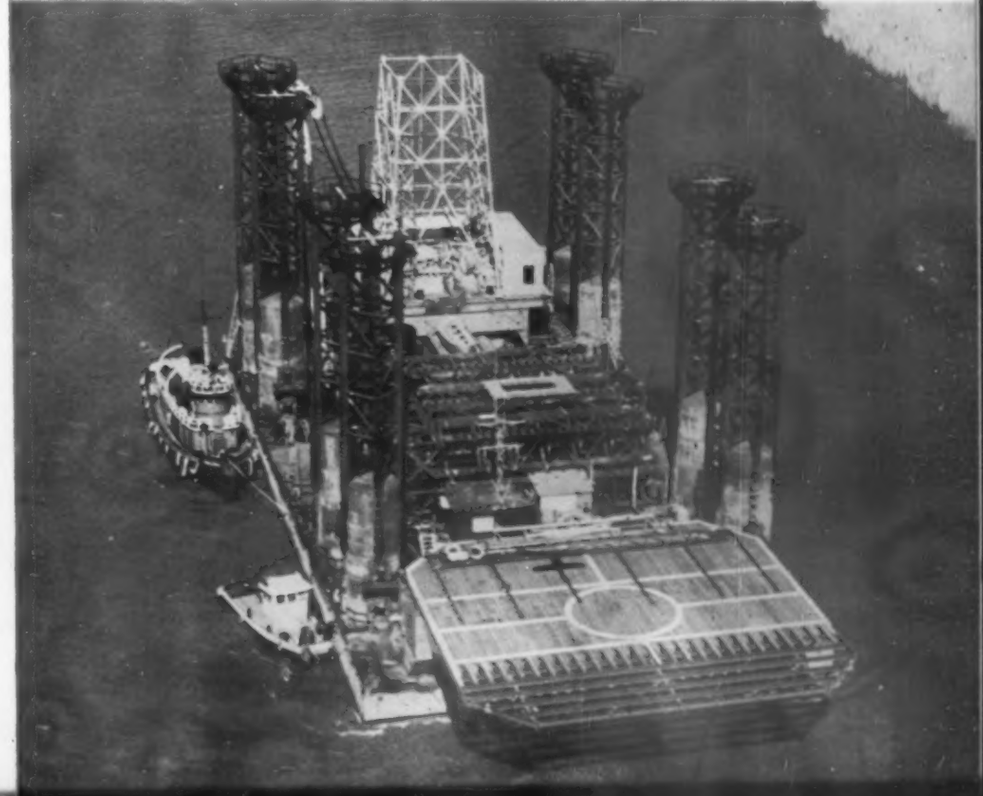
Electrical and mechanical work shops located in the hull make it possible for the maintenance crew to handle all equipment repairs short of a major overhaul requiring large shop facilities. Adjacent the shops is a storeroom where sack mud, cement, chemicals, major spare parts and daily consumable maintenance supplies are stored. On the same level is the fully equipped "ship's laundry" in which duplicate machinery has been installed to always assure the availability of these facilities.

The bulk mud system is located between the storeroom and the engine room and includes 8 hoppers, each with a capacity of 500 sacks of dry mud. The mud is moved by a Fuller Pneumatic conveying system which carries the dry mud in a closed conveyor directly to the mixing tanks on the main deck.

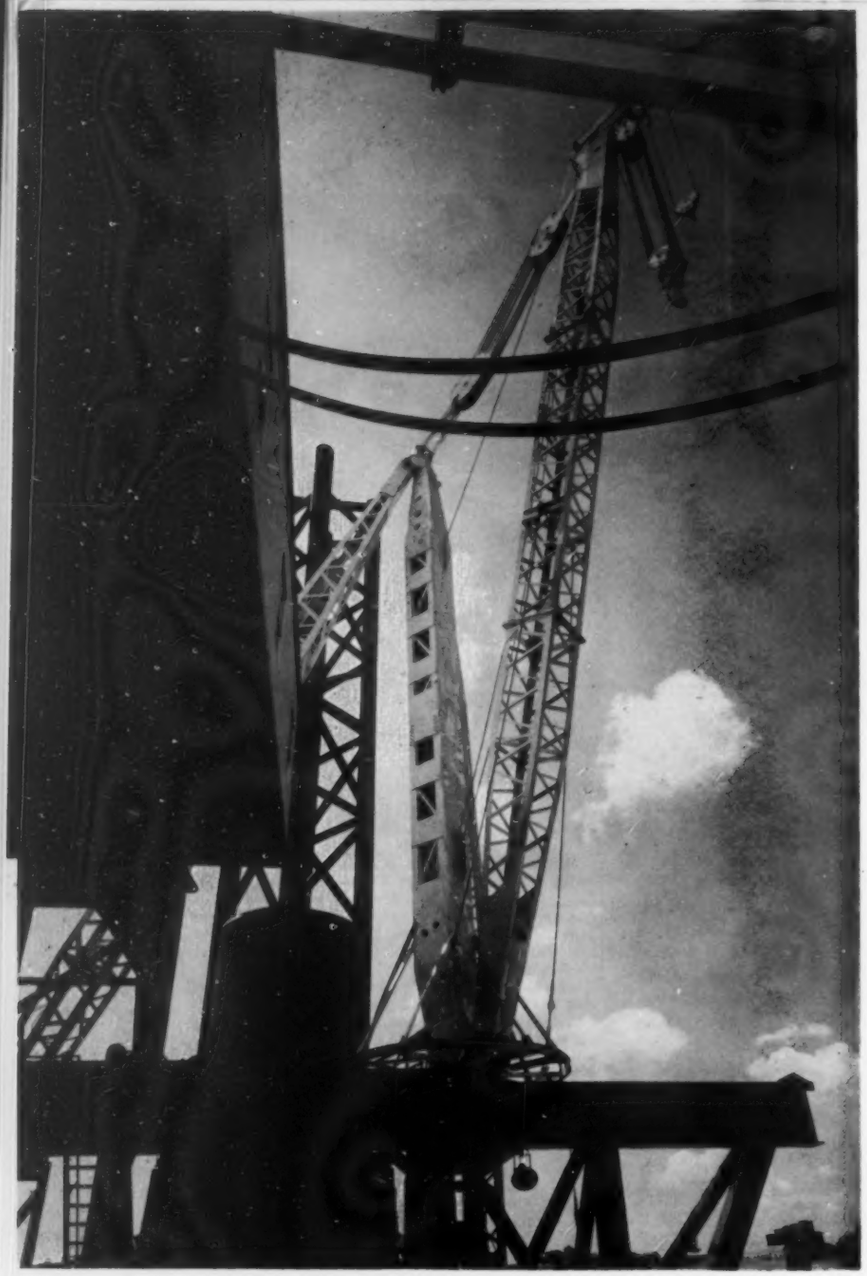
The main deck of the platform provides the space for the entire drilling rig, its complementary equipment and a fully air-conditioned quarters building which can house 66 men. The after end of the platform contains a 43 x 26 ft drilling slot around which the drilling equipment is located for maxi-

J. D. Wells is chief mechanical engineer for Pan American International Oil Corp., New York City. He joined the parent Pan American Petroleum Corp. as a project engineer at Tulsa in 1948 and as assistant to the chief engineer he served in various supervisory posts at Houston and Brownsville as well as Tulsa. He was marine operating superintendent at Houston and chief mechanical engineer at the Amoco Chemicals Corp. synthesis plant formerly operated by Pan American. Both companies are Standard Oil Co. (Indiana) subsidiaries.

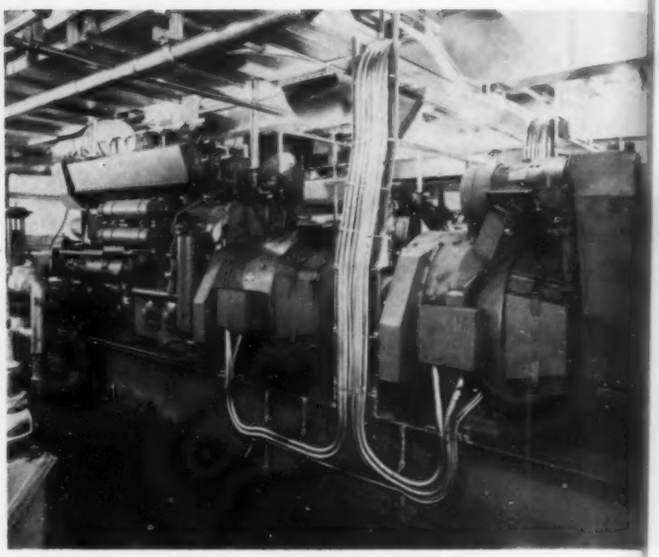
From June, 1952, to April, 1953, Mr. Wells served as chief of production, Natural Gasoline Division of the Petroleum Administration for Defense, Washington, D. C.



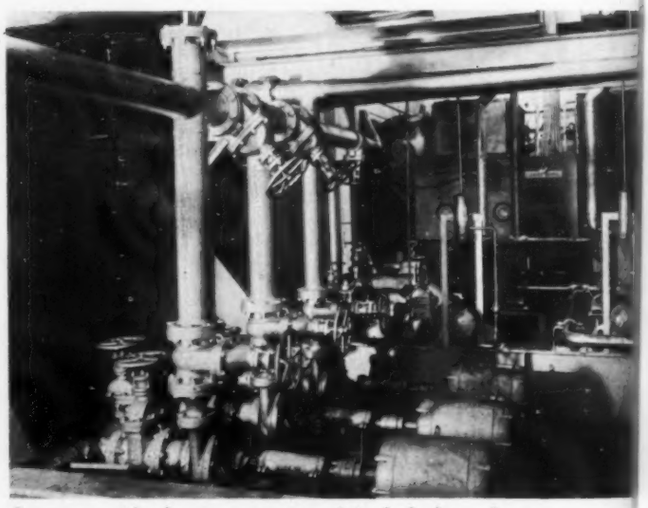
The platform, with mast partly dismantled, on the first leg of its 10,800-mile trek.



100-ton stiff leg derrick mounted on the platform. It is used for setting the well protective structure after the platform is on location.

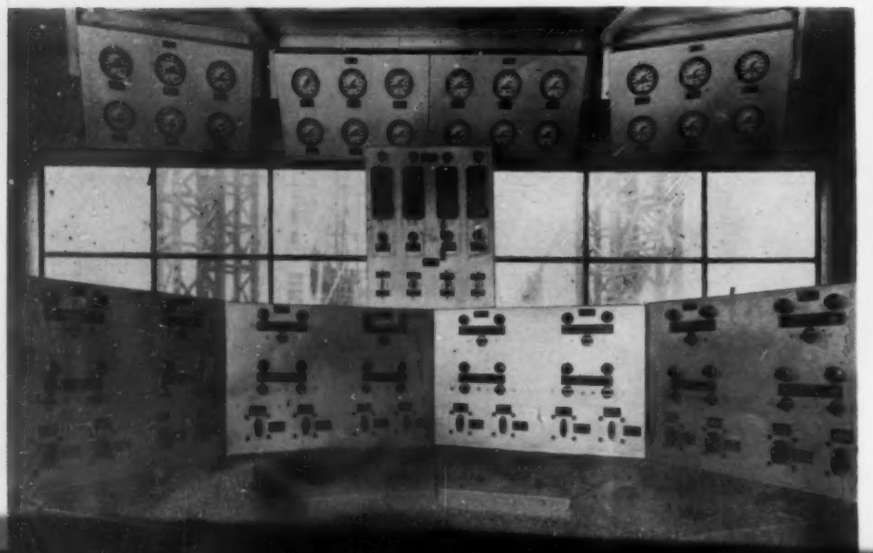


Main DC generators with the Alco Products Diesel engine drives.

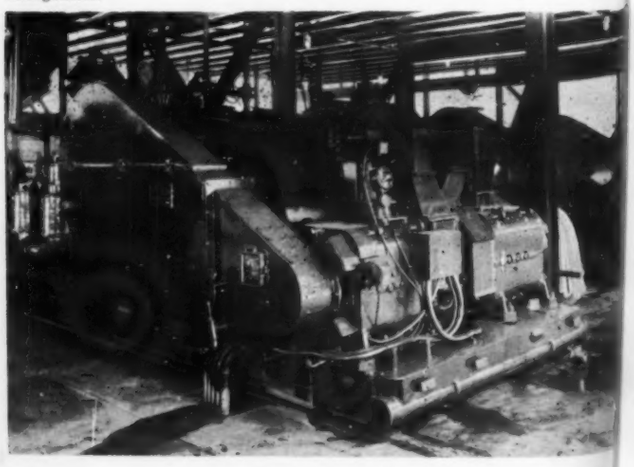


Pump room with salt water evaporator unit in the background.

Control room for the DeLong hydraulic jacks which raise or lower the platform.



Emsco mud pumps. Two pumps are used, with a third available for emergencies.



mum operating efficiency. Just forward of the slot are two Emsco D-850 unitized mud pumps, each driven by two 600-hp General Electric traction type DC motors. A third pump of the same size and make, driven by a Caterpillar D-397 diesel engine is located in the same area. This auxiliary pump is normally used only for mixing or for down-hole circulation in the event of a loss of electric power. However, as it duplicates the main pumps, it could be used as a spare in an emergency. The two active and two reserve mud tanks, pump manifold and mud ditch are all located adjacent to the pump area. The pump manifold, one of the features of the rig, is designed so that any of the pumps can take suction on any one of the active mud tanks or the reserve mud tanks and can discharge directly to the rig or back into the tanks. The main suction line is sized to supply the maximum demand of the two main pumps without restriction. Adjacent to the mud tanks on the port side of the platform is a fully equipped change house including a laundry for the crew's clothes.

The platform has a 100-ton capacity Boom and Crane Corp. special stiff leg derrick with an 85-ft main boom and a three-drum Clyde hoist powered by a 125 hp motor on the after starboard corner of this deck which is used for setting the well protective structure after the platform is on location.

At the center of the platform is a Manitowoc Model 2000-B locomotive type speed crane with an 80-ft boom. This crane is mounted on a six-wheel under-carriage and operates on transverse rails across the full width of the platform. This crane handles all tubular goods and bulk materials aboard the platform and is also used for offloading all materials from the service boats.

Directly above the mud tanks is the elevated pipe rack structure in which are incorporated the skid beams which support the specially built substructure. The latter is a girder type structure which spans the width of the drilling slot and is designed to move fore and aft a distance of 40 ft. It is also designed to permit the derrick to be moved laterally a distance of 7½ ft either side of the center line of the slot. The derrick is a 140 x 30 x 7½ ft Parkersburg Galemaster, API safe load rated without reinforcing at 1,100,000 pounds and designed for a 100 mph wind load.

The drilling rig consists of an Ideco E-2500 draw works with double drum, air controlled with four speeds forward and four reverse on the main drum and two speeds forward and two reverse on the sand-line drum. Power for the draw works is supplied by two 600 hp General Electric traction type DC motors. The draw works is equipped with a 60-in Parkersburg single rotor hydromatic brake. The rotary table is an independent drive Ideco model HS-275 streamlined 27½-in rotary powered by a 600 hp motor similar to those driving the draw works. The rotary can also be driven from the draw works if necessary. The crown block is an Ideco 560-ton with seven 55-in diameter sheaves, one 12-in diameter catline sheave and one 20-in diameter sand-line sheave. The travelling block is an Ideco 480-ton six sheave block and is equipped with an Ideco "Tru-line" 500-ton swivel.

The drilling equipment also includes a Warren Automatic Tool Co. Mud-o-Graf, Swaco Total Mud D-Gasser, a Koomey Model T4HD Blowout Preventer Control System, and a Medearis Type X Shale Shaker. Adjacent the derrick floor is an air-conditioned paleontology and mud laboratory equipped for immediate onsite analysis of samples.

A Halliburton Twin T-10-AC Skid-Mounted Cementing unit is located on the main deck just forward of the mobile crane. Included with this unit is a bulk cement handling system. The tanks for this system are loaded on shore, thus eliminating the handling of cement on the platform except in case of emergency.

The fully air-conditioned quarters building which can accommodate 66 men is located at the forward end of the platform. Each of the staterooms is furnished with bunk beds and wardrobe lockers for each crew man and for service personnel aboard the platform. Combination stateroom-offices are provided for the drilling contractor's tool pusher, the company tool pushers and the company's drilling superintendent. The first deck of the quarters houses the stainless steel all-electric galley adjacent to which is a walk-in cooler and a walk-in deep freeze. Portable walk-in chill boxes are used to transport frozen and perishable foods from the shore base to the drilling location. These boxes are supplied with their own refrigeration units which are operated from the ship's power supply while aboard the service boats enroute to the platform and can be plugged into the AC power system aboard the platform if additional cold storage space is required. A dry storeroom next to the walk-in deep freeze provides the platform with a minimum of one month's supply of food. The mess hall can serve 24 people at one time, or 32 in an emergency.

On the same deck of the quarters as the galley, is a First Aid Room with a medical attendant on duty 24 hours/day. Any injury short of a major casualty can be taken care of on the platform. Staterooms are available on this same level for the galley crew, quarters keepers and a portion of the drilling crew.

In addition to the supervisors' rooms, staterooms are provided on the second deck of the quarters for the balance of the crew. This deck also houses an L-shaped recreation room designed so that multiple activities can be carried on simultaneously without interference.

An air-conditioned combination tool pushers office and communications center was added on top of the quarters building. This facility is located so that it affords a completely unobstructed view of the entire drilling rig and is connected by a 12 station telephone system to all of the major operating areas on the platform and to the tool pushers' and drilling superintendent's staterooms.

One of the major features of the platform is the communications network which includes the following: RCA single side-band communications transmitter-receiver for continuous contact with the shore base, the supply boats and the Company's drilling tender, Panintoil 1; V.H.F. radio for communication with the helicopters; Redifon non-directional radio beacon; and a Raytheon radar unit which was modified for a 100-mile range for weather use. In addition to the platform based equipment, the shore base is connected to the Tehran office by means of a leased microwave channel which can be inter-connected to the single side-band networks and permits direct contact between Tehran and the drilling rig.

A portable bridge was installed between the quarters roof and the elevated pipe rack so that the tool pusher on shift has direct access to the rig. This bridge is constructed so that it can be located on either side of the platform and has a center section which can be easily removed to permit the crawler crane to operate throughout the entire width of the platform. The drilling rig's Schlumberger unit and the control house for the DeLong jacks are also located on the roof of the quarters building.

Supported at one end above the quarters building and extending approximately 50 feet beyond the forward end of the platform is an 80-foot x 80-foot helicopter deck. An innovation incorporated into this deck is a refueling station which permits the helicopters to carry a maximum payload on all flights to the drilling site. As a safety precaution the bulk fuel tanks are designed so they can be ejected overboard of the platform in case of an emergency.

A review of the major equipment on board the platform quickly emphasizes the advantageous use that has been made of duplicated driving units. The active mud pumps, the draw works and rotary are all driven by 600 hp General Electric traction type DC motor; the AC generators and mixing mud pump are driven by Caterpillar D-397 diesel engines; all four anchor winches and the Halliburton pumps are driven by General Motors 671 diesel engines. These same drivers have been used for like items of major equipment on the company's drilling tender which is now rigging up in the Persian Gulf. This obviously minimizes the spare parts required and simplifies the preventative maintenance program.

The drilling rig is supplied by the Panintoil 20, a 134 ft Gulf of Mexico type supply vessel, and the Panintoils 21 and 22 which are converted LSMs. All three vessels are equipped with towing bits and the "21" also has a towing winch which makes it usable as a tug for moving the mobile platform between locations.

The drilling crews are transported to location in two S-55 helicopters which the company has on lease from Bristow Helicopters, Ltd. END

Russia speeds electric drill development and testing

Slim hole electric drills are being given extensive field tests. Larger sizes are produced in quantity.

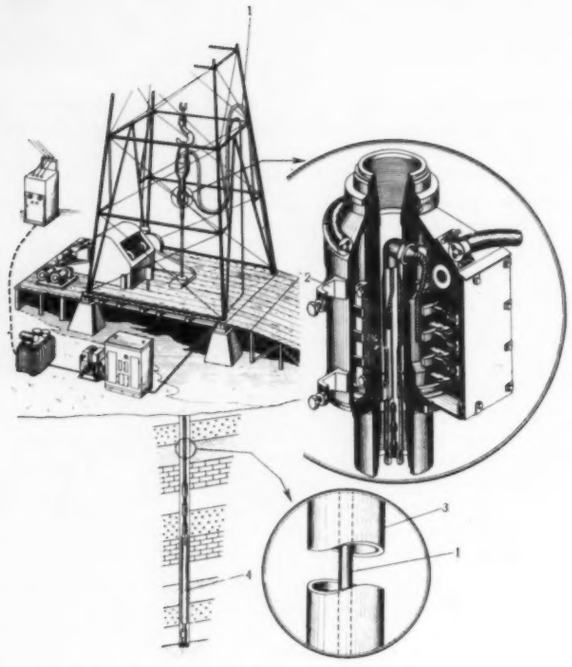


Fig. 1. Rig Layout for Electrodrilling. 1) Cable. 2) Collector. 3) Drill Pipe. 4) Electrodrill.

PRODUCTION OF 150 electric bottom-hole drills is planned by the USSR in 1960 according to reports from Russia. Of this number about 25 will be of a size suitable for use with 4½-in. drill pipe.

Development of slim-hole drill pipe has been slow in Russia, possibly because of emphasis on the turbodrill which requires a larger diameter for satisfactory operation. Steel economies resulting from slim hole techniques are highly important in Russia, however, so the industry is pushing production of small diameter drills and pipe and 33% of 1960 wells will use the slimhole technique. It is believed by Soviet drilling technicians that the electric drill will supersede the turbodrill.

Development of the electric drill was begun in 1952-53 and prior to this year 30 drills had been manufactured. This year it is reported that 100 rigs equipped with electric drills are operating in the field. Commercial operation has suggested the following advantages:

1. The weight on the bit, the torque on the bit and the speed of the bit can all be controlled, whereas with conventional rotary drilling one can only control the weight on the bit, and the torque and speed of the bit are limited by the restrictions involved in driving the drill by the rotary table, which has a maximum speed of 250 rpm, and the torque is limited to the twist-off strength of the drill pipe. Similarly, with the turbo bit one can control the weight on the bit, but the speed and torque are subject to the volume or circulating fluid that has to be pumped down to raise the cuttings. Consequently the turbodrill races or slows down directly proportionate to the drilling resistance, without means of surface control.

2. The electric drill could be used like the turbodrill, to drill two wells simultaneously, since no drill collars are necessary to produce weight on the bit.

3. By a device in the electric drill, deviation of hole is continuously recorded without stopping the drill.

4. The horsepower of the electric drill can be controlled, and the speed can be varied between 300 and 700 rpm. At any given horsepower or torque setting required, the drawworks can be made to feed pipe automatically, since a given horsepower means a certain amperage is required, and if the drill runs into a hard formation, this amperage would rise, and a make-and-break device on the surface can be made to reduce the feed of the drill pipe automatically. Vice versa, if the drill feeds into a soft formation, the amperage will fall, and this can make the same automatic control device speed up the drawworks feed of drill pipe into the hole, so that a constant equilibrium of power is obtained.

The big question with the electric drill is whether the packings will stand up to the much higher hydraulic horespower and the pressure drop used in the West due to the extensive use of jet tri-cone bits. The Russians are planning to equip some drilling rigs with 4½" drill pipe and their new models of electric drills, and use casing sizes equivalent to the West, namely 13⅜", 9⅝" and finally 7" casing, with jet bits and with mud pumps of 1,000 hydraulic hp. These tests should prove whether or not the electric drill, and for that matter the turbodrill, will stand up to these high hydraulic pressures. The Russians in laboratory tests have subjected the electric drills to pressure drops much greater than those required and experienced with jet bits, and the electric drill withstood these tests.

Surface equipment on Russian drilling rigs is featured by the widespread use of automatic break-out tongs which differ materially from the manually operated power tongs used in the West. There are now more than 300 automatic tongs operating.

On new Russian rigs now being delivered automatic pipe racking is provided where only one hole is being drilled at a time. Many rigs in the USSR are equipped with two rotary tables. When a bit is to be changed the driller lifts a stand of pipe and attaches it to a second drill which is then fed to the second hole. This process is continued so that no pipe is stacked, the driller is always feeding pipe into one of the two holes.

In those rigs with automatic pipe racking the equipment is operated in conjunction with the automatic breakout tongs at the floor level and an automatic stacking arrangement at the fourble platform level on the mast which operates as the block passes actuating devices. This is a relatively new development.

In recent years about 80% of all wells in the USSR have been turbodrilled. Only a small portion are drilled with mud from the grass roots down. Water is the principal drilling fluid. Even in those when some mud is used the densities are low because formation pressures are not great.

Also due to the relatively low formation pressures the Russians do not need high hydraulic horsepower and pumps, and rarely use jet tri-cone bits. With the jet bit, something of the order of 60% of the hydraulic horsepower from the mud pumps is necessary to produce the pressure drop across the face of the jet bit in order to enable it to work effectively so that in the West mud pumps of 800 to 1,000 hp are employed, where the Russians, on comparable rigs drilling to comparable depths, only need to use about 400-500 hp. The turbodrill in Russia is not subject to this differential pressure between the inside and the outside of the turbo and consequently the packings do not have the same arduous conditions to work in as in the West. END

How to minimize production costs

by Lester C. Uren

Competent petroleum engineers can conduct studies of operating procedures and equipment which will contribute to the cost reductions necessary under today's oil industry conditions.

DURING THE LAST THREE decades, the economy of the United States has been confronted with inflationary conditions resulting in continued pressure to increase prices of all goods and services and reduction in value of its currency. Though the selling price of the gross national production of goods has greatly increased, the inflationary demands of powerful labor unions, operating without any effective brake on their activities, have compelled ever increasing production costs and selling prices for products. This has resulted in pricing some American products in which we have formerly held world dominance, out of our own domestic markets. The domestic oil-producing industry today could not compete in a free world market without the aid of government import and other artificial restrictions.

To contend with this situation, oil and gas producers have been compelled to adopt all possible means of reducing production costs. Engineering studies have disclosed possible economies in many industry operations and knowledge of these and ability of management to apply them in practice will, in large measure, determine the success of an oil-producing company in competing in today's highly competitive markets. Detailed discussion of cost-reducing procedures is not feasible in the brief space afforded by a single article but, it is hoped, in the following paragraphs, to briefly outline some of the means by which minimum production costs may be approached.

Development of a Suitable Cost-Finding System. The first requisite in any study of production costs is the development of a suitable cost-finding system. This should be sufficiently detailed to provide a complete record of the cost of each phase of operations and the cost of every item of expense. A skilled accountant, familiar with oil industry operations and with cost-finding technics, should be employed to survey all operations and plan a system of records and forms that will assemble, organize and display all data essential for a complete analysis. Only by comparing costs after changes in methods have been made with costs by earlier methods can the quantitative advantages of new methods be appraised.

General Procedure in Cost Reduction. We can reduce the unit cost of producing petroleum either by finding means of reducing the actual cost of the operations by which the oil is produced, or by finding some means by which the rate of production or ultimate production may be increased without adding materially to the operating cost. Some methods of lifting oil from wells are less costly than others; some sources of power and methods of applying power to well-pumping operations are less costly than others; and if by appropriate adjustments one of the less expensive methods may be employed, important economies may be realized. For example, gas-lifting oil from wells is generally less expensive on a unit cost basis than plunger pumping, and the latter method will ordinarily not be used as long as we can keep the wells operating efficiently by flow methods.

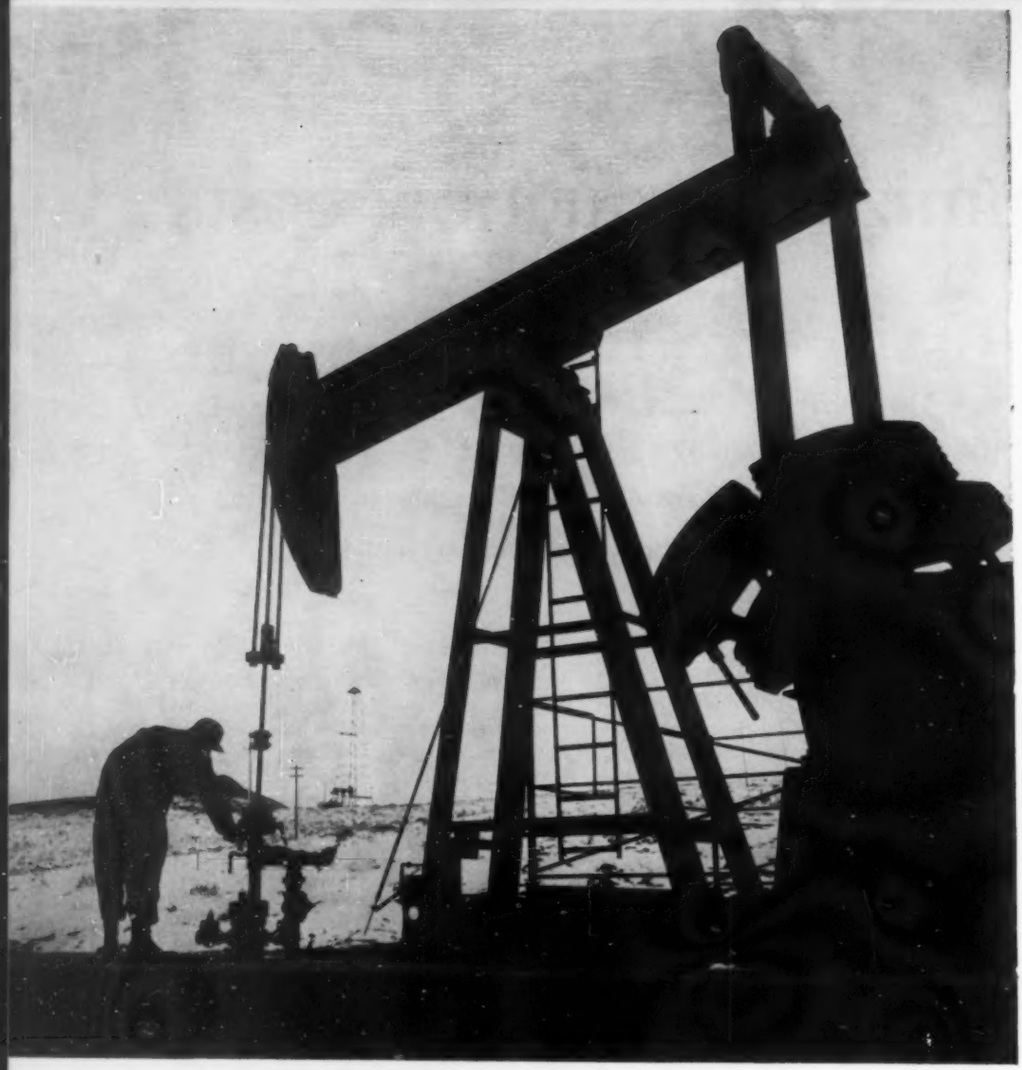
Tests may disclose that it costs but little more to pump a well producing 50 b/d than one producing 25 b/d so that the unit production cost may be reduced materially if the wells can be kept producing at the higher rate. Perhaps this may be done by gravel-packing the well, by acid treatment of limestone reservoir rocks, or by hydraulic fracturing of the reservoir rock in the vicinity of the wells. Or, an increased rate of production per well may be realized by wider spacing of wells. On the other hand, the discounted present value of future production will be increased by closer well spacing, thus shortening the period of realization of profits. Automatic devices may permit of carrying on field operations with less labor than is otherwise necessary, resulting in material reduction in production cost without any change in the rate of production.

Labor cost is generally the most important element of production cost and reduction of labor cost through more efficient use of labor in producing operations will often make an important contribution to greater profit. Native skill and intelligence of workers will be basic factors in determining labor efficiency, but training and education designed to improve application to the job will further improve labor efficiency. To this end, close observation of field operations and time studies may disclose less costly ways of doing them.

Organization of the labor force is highly important. How many men can be most effectively used in a field group such as a drilling or "well pulling" crew or a pipe-laying "gang"? What should be their individual duties and what special skills must each possess? What daily or hourly wage shall each receive? What degree of supervision will be advisable? To what extent may automation permit of reducing the number of workers employed or the special skills required of them, and how may automation be applied to each field operation? Organized resistance from labor unions may prevent full realization of the benefits that might be achieved by these procedures, but their potential influence on production costs should be studied to provide a basis for labor contract negotiations.

Possible Economies in the Company Headquarters Organization. All departments of the company organization should be studied for possible economies. A good place to start is in the company's headquarters establishment where the management personnel is concentrated. This may conveniently be followed by a study of the field development practices, and finally attention may be focused on the production phase of field operations.

It may be heresy to look for inefficiency among those who are responsible for the conduct of the entire organization, but it often has its roots there and the "brass" at headquarters should be willing to have a look at their own organization, methods and procedures before looking elsewhere for possible economies in operations. Is the organization of personnel at company headquarters such as will secure the most efficient conduct of operations? Is every phase of the company's operations fully represented by competent officials in the headquarters establishment and are the interrelationships between members of the headquarters staff properly defined? Are these staff officers suitably coordinated with field



Pumping well in Oregon Basin field, Park County, Wyo. Photo courtesy The Ohio Oil Co.

personnel in their several specialties and are they kept fully informed of the conduct and progress of field operations for which they are responsible? A well planned organization chart will give assurance that these questions will yield satisfactory answers.

Has provision been made for prompt and complete communication between company headquarters and field personnel? This may be achieved by a well planned report system which requires the field personnel regularly to prepare detailed reports on all field operations, including cost records or essential data from which cost records may be compiled. Most of the cost records will be prepared by field personnel in close touch with the field operations, but some cost items relating chiefly to "overhead" expense may be added in the headquarters offices.

An important phase of the work done in the headquarters offices relates to budgeting and reaching decisions on projects to be given precedence in field operations. This is probably the most important aspect of oil-company management and is preferably entrusted to a small representative committee rather than to a single individual. Here decisions are made which will determine the success or failure of the company, its profits or lack of profits. The members of this committee must therefore be men of seasoned business judgment, familiar with all aspects of the oil and gas industries. Control of the company's working capital, its potential and producing oil lands, physical plant and marketing facilities will present many profit-making opportunities. Each proposed project will be carefully analyzed to determine its probable cost, pay-out status and potential profit. Each year the budget committee will choose among these "on-the-shelf" proposed projects those that offer maximum profit or that seem to be the more timely in the long range plans for exploitation of the company's properties.

Minimizing Development Costs. A large part of the cost of oil and gas production is represented by field development costs: capital expenditure incurred during the early life of a producing property that must be amortized by a unit charge against all future production. Thus, each barrel of oil and each thousand cubic feet of gas produced must bear its share of the original development costs. Any economies that are possible in this phase of operations must be planned in advance, for once the development work is completed, its cost is "frozen" into the records and cannot be reduced. However, development costs can be increased at any time if additional development work is done.

Well Spacing. In planning the development program for an oil- and gas-producing property, decision must be reached concerning the number, spacing, location and diameter of all of the wells, their depth and the manner in which they shall be cased and completed. An oil reservoir will be drained of its oil and gas to some extent irrespective of the number of wells drilled and their spacing; but if proration restrictions permit, the reservoir will be more rapidly drained if the wells are closely spaced and the present-day, discounted value of the oil and gas will be greater than if the wells are widely spaced. However, the total cost of the smaller number of widely spaced wells will be less than the cost of the greater number of closely spaced wells and may more than offset the shorter period of realization of profits from closely spaced wells. Wide spacing requires that wells be operated over a longer period of time, but this long-period operating cost may be partially offset by the lower cost of operating the smaller number of wells. Conversely, the greater number of closely spaced wells will require increased cost of operation, but the operating period will be of shorter duration.

Leading authorities profess to believe that a reservoir may be as effectively drained by widely spaced wells as by closely spaced wells. Some are in favor of allowing as much as 40 acres per well. However, geologists familiar with the lateral variations in texture, porosity and permeability of reservoir rocks that usually occur, and with the effects of small faults, "stringers" and other impermeable barriers that often interfere with long-distance migration of oil and gas within the reservoir, do not agree that such wide spacing of wells will normally result in as efficient drainage as is possible with more closely spaced wells. Aside from the physical aspects of oil drainage it is clear that economic considerations must determine some optimum well spacing which will yield maximum profit. The factors involved in determining the most profitable number of wells are numerous and some of them can be estimated only approximately; but the most advantageous well spacing must be estimated as accurately as possible for it offers one of the principal opportunities for savings in oil and gas production cost.

Economic Advantages of "Slim-Hole" Drilling and "Permanent Completions." Substantial savings in casing tonnage and cost may be realized by reducing well diameters and using the smallest diameter of casing consistent with subsequent well maintenance and production limitations. Conventional well diameters are often 8⅝-in. or even 10-in. in diameter, whereas "slim hole" diameters range from 4¾-in. to 6¼-in. Slim-hole practice in some cases has involved setting a 4½-in. casing string in a 6⅛-in. hole.

In 1957, one operator drilled 437 slim holes with an estimated cost reduction of $2.9 million, or 15%, in comparison with

the cost of drilling conventional wells in the same area. In one case, a 6¾-in. hole was drilled to a total depth of 9,750 ft in an area where 8⅝-in. or larger holes were previously considered necessary. The well was completed with 4-in. casing and 2-in. regular tubing, using a total of only 85 tons of tubing and casing. The drilling time was reduced five days and the total cost was 32% less than the cost of conventionally drilled wells in this area.

The demonstrated economic advantages of slim-hole drilling have led logically to the development of "permanent completion" techniques in which a small casing is cemented permanently in the well to serve the purposes of both casing and tubing. All completion, producing and maintenance operations are conducted through the small diameter casing, often with the aid of miniature tools that have been designed especially for this purpose. The larger and heavier rig used in drilling the well can be removed as soon as it is equipped with tubing and well-head controls, thus reducing drilling rig time to a minimum. Subsequent cementing, testing, coring, logging, perforating and well completion operations can be conducted with light truck-mounted surface equipment. Hole sizes as small as 4¾-in. with 2-in., 2½-in. or 2⅞-in. tubing cemented in the wells as oil strings have been successfully used in many cases, without serious loss in productive capacity: adequate in any case in heavily prorated areas. Compared with conventional wells, using 5½-in. casing and 2-in. tubing strings, a 7,500 ft tubingless completion, using 2½-in. casing, offers a potential saving of 43% in tubing and casing costs alone. Additional savings may be realized through reduction in drilling-rig time and the use of lighter and less expensive rigs for completion operations.

Economic Advantages of Dual Completions in Multi-Zone Fields. In many oil and gas fields, the producing formations are found in two or more stratigraphic intervals within the same surface areas. Commercial production may be had from more than one depth interval. Until recent years it was considered impractical to complete and operate a well to produce from more than one zone at a time, so that separate groups of wells were drilled to produce from each zone or wells were deepened to produce from successively lower zones as upper zones were drained. Modern technics now permit of arranging and operating equipment in a single bore so that production may be had from two or more zones simultaneously. Sometimes dual or triple completions offer definite economies in comparison with the practice of drilling separate wells to each zone. The lower cost results from reduction in footage drilled, preparation of drilling sites and access roads, and savings in casing and well-head and pumping equipment.

In West Texas fields, in 2,000-ft territory, a dual completion costs $13,000 less than two single-zone wells; and for wells 10,000 ft deep, a dual completion may cost $90,000 less than two separate wells. However, there are certain disadvantages in maintenance and operation of multi-zone completions that will perhaps, offset the initial advantage in development cost, and a prudent operator will carefully weight the advantages and disadvantages before adopting the dual completion technics.

Removing Drill Cuttings by Circulating Compressed Air or Natural Gas Instead of Mud Fluid May Reduce Rotary Drilling Cost. Compressed air or natural gas has lately been widely used as a circulating medium in rotary drilling for removal of drill cuttings instead of the conventional mud-laden drilling fluid. Under favorable conditions, this practice has definite advantages. More rapid drilling progress, reduction in rig time, increased bit footage and reduction in the amount of drilling fluid required, often result in reduced drilling cost. Other advantages include less difficulty in drilling through zones where loss of circulation is common, and better opportunity for accurate logging of the formations penetrated; there is comparatively little contamination in securing formation samples and potentially productive formations may be tested without resorting to drill-stem testing. However, the method may not be practical in drilling through formations that yield water to the wells, unless some means can be found to exclude most of the water. Moderate amounts of water may be sealed off under favorable conditions to permit air or gas drilling, but unfortunately the sealing agents available for this purpose are expensive and their use may offset the lower cost of the method.

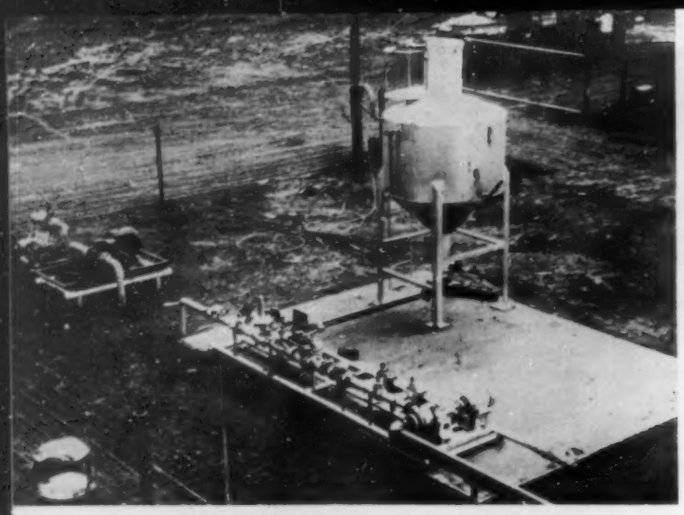
Possible Economies in Conventional Well-Drilling Operations. The drilling of wells and operations incidental thereto are largely in the hands of contractors; nevertheless this phase must be considered as an integral part of the oil and gas industry and any economies that the contractors may be able to realize will be reflected in the oil producer's well costs.

There is demonstrated cost advantage in using light, portable rotary rigs, wherever possible, unitized to facilitate rapid assembly and disassembly and low cost transportation. Power costs are important and choice of a type of power plant best adapted to the work in hand will offer economy in operation.

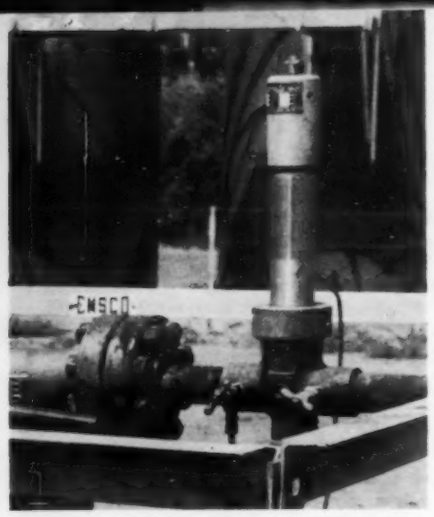
The unit cost of drilling can often be reduced by closer engineering supervision and by better training and organization of drilling crews. Any changes that will increase

(*Continued on page 70*)

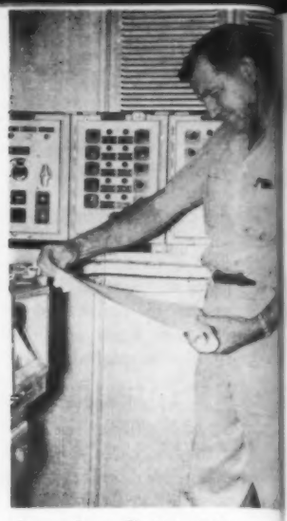
Drilling crew of an Ohio Oil Co. well in the Bradley field, Oklahoma. Photo by Anthony Linck for Ohio Oil Co.



Positive displacement meter, automatic custody transfer.



High-low pressure shut-in valve for well control.



Automatic well test programmer and data printer.

Automatic lease systems

by William J. Rapson, Jr.

MORE WIDESPREAD USE of lease automation techniques has taken place within the oil and gas production industry in recent years. After a period of rapid development oil producers and equipment manufacturers obtained operating experience which has resulted in more efficient methods to produce and handle oil and gas production.

Automation in the oil field probably started with the first liquid level controller and dump valve that were installed on a gas oil separator. Back pressure, regulators, and safety relief valves are examples of automatic controls accepted as routine. Many such automatic devices are so common that we do not consider them in that class.

When it became feasible to utilize similar equipment to turn valves and direct flow from one line to another line, the field of automation, as we know it today, mushroomed. The rapid growth made it difficult for production personnel to keep current with changing equipment and techniques.

To simplify understanding of this equipment, remember that most automatic control devices have a function that can be compared with manual operation. An automatic valve substitutes for a manual valve physically operated by a man; an automatic controller duplicates routine thinking of the man.

William J. Rapson, Jr., sales engineer with Garrett Oil Tools division of U. S. Industries, Inc., Longview, Texas, was graduated from Rice University in 1954 and was with Southwestern Industrial Electronics and Oil Well Supply Co. before joining Garrett Oil Tools in 1957.

By arranging lease automation techniques into functional groups, practical analysis can be made to determine the optimum methods. Definite approaches to most applications are available. Naturally some cases will involve special attack but a realistic analysis can provide good solutions.

From the well to the pipeline six logical phases will be used for this discussion as follows:

1. Well Control
2. Manifold Control
3. Test Metering
4. Automatic Programming
5. Data Recording
6. Custody Transfer.

The phases are illustrated respectively in Figure 1 through Figure 6. For each phase practiced and proven optional methods are pictured. For example, Figure 1 shows that there are at least five methods for controlling pumping and flowing wells. It is evident, that there are numerous ways by which well fluid can be automatically produced from a well, separated, tested, metered, and shipped to the pipeline. By selecting the proper component from each figure, an optimum system may be defined. In special situations, the illustrations may serve as guides and the final system tailored to the specific application.

A resume of the techniques used in automatic lease systems and the illustrations is given following:

Well Control: Figures 1A and 1D illustrate methods used on flowing wells and figures 1B, 1C, and 1E show control techniques on pumping wells.

Well control is used to provide safety in cases of abnormal pressure caused by well condition, flow line break, or shut-in by manifold control. Well control is also used to control producing periods of a well by production programming. The well control device may be linked to manifold control and/or automatic production programming phases.

High-Low Pressure Shut-in Valve (Figure 1A): This valve will automatically close on excess high pressure, which can result from shut-in at manifold or from abnormal well condition. The valve protects low-pressure flow lines from high pressure. The valve also uses low pressure control to protect against flow line breaks. Production programming may be accomplished at the central manifold control by closing a 3-way, 3-position valve for the well with the automatic production programming (production programming refers only to scheduling of regular producing periods and should not be confused with well test programming).

High Pressure Shut-in Valve with Control Switch (Figure 1B): Automatic shutdown of pumping wells in case of high pressure can be accomplished with this valve. A high pressure control causes the valve to automatically close on a preset flow line pressure. When the valve closes, a switch mounted on the position indicator of the valve opens the motor starter circuit or grounds engine ignition to stop the pumping unit.

This method is used on wells which will flow when the pumping unit is not operating. The motor valve completely shuts in the well and assures that the pump does not operate when the motor valve is closed.

Central automatic production programming is accomplished as described in the previous item. Control of pumping periods can also be done with time controls at the well but the advantages in central programming are not available.

Pressure Switch (Figure 1C): On pumping wells which produce dead fluid (wells which do not flow when pumping unit is stopped), a pressure switch can be used to

shut in pumping unit on high pressure caused by closing of the manifold control valve. The pressure switch interrupts motor control or grounds engine ignition to stop the pumping unit.

Remotely Operated Shut-in Valve (Figure 1D): An automatic valve can be connected to a central production programmer. However, this method requires installation of control wires (either buried cable or overhead lines) from the valve to the central programmer.

Control of well flow periods can also be accomplished using time clock controlled intermitters.

Remotely Operated Motor Control (Figure 1E): Where pressure switch operation will stop production, a well may be controlled from central production programming over control wire.

High pressure flow lines do not require well control valves except for protection in cases of flow line breaks. If production programming and/or safety shut-in is not used, well control equipment is not required. The proper choice of well-control depends on many factors. Safety shut-in and production programming are the influencing factors to be considered.

Manifold Control: To consolidate producing facilities, well flow lines are connected to a common valve manifold. This manifold allows isolation (diverting) of the individual wells for testing individual well characteristics. Flow periods for individual wells may also be scheduled at the production-test manifold. Emergency shutdowns of all wells can be accomplished at the manifold.

3-way, 3-position Manifold Valve (Figure 2A): 3-way, 3-position automatic valves are used to direct flow from the well to production facilities, to test facilities, or to shut in the well. Production programming is accomplished by interconnecting the production side of valve to the production programmer. Test programming is obtained by connecting test side of valve to automatic well test programmer. Emergency shut-in for safety will cause 3-way, 3-position valves to fail closed.

It must be remembered that when a well flow line is shut in by the valve, appropriate well control must be used.

3-way, 2-position Manifold Valve (Figure 2B): Where production programming at the manifold is not desired, 3-way, 2-position automatic valves are used in the manifold. Wells normally flow through the valve to production facilities. Individual wells may be diverted to the test metering equipment. The valves are controlled by the automatic well test programmer.

Emergency shut-in for all wells is handled by a common valve on the production outlet of the header. When this valve is closed, pressure increase on the flow line is conveyed to well controls. Shut-in may also be handled by control lines from production programmers to individual well control or by removing power from all individual wells and prime movers where central programming is not used.

Test Metering: After the selection of the appropriate well control and manifold control the method for separating the components of the well fluid and the metering of those components must be resolved.

As in conventional operations, the choice between 2-phase separators; 2-phase, 3-component separators; and emulsion treaters depends upon the quantity and quality of the well fluid. From the flow diagrams of the most commonly used techniques—Figures 3A, 3B, & 3C—it may be seen that the selection of separating and treating equipment is influenced by the type of metering equipment.

The relative importance of oil, water, and gas measurements is dependent upon the situation. For instance in water-flood operations, water measurement is important for sweep-efficiency calculations but gas measurement is not too important. Conversely gas measurement can be critical on high gas-oil ratio wells while water measurement might be omitted altogether.

Gas Metering Equipment: Since automatic well testing requires automatic metering, chart type meters are not practical. Pressure-compensated integrating orifice meters are the most commonly used gas meters to give an impulse output for specified quantity of gas passing. The orifice meter still has a limited range of rate measurement (about 4:1) and several meter runs may be required to handle wells producing widely different gas volumes.

The use of positive displacement (rotary and diaphragm types) has become more prevalent recently. These meters have a wide range (20:1).

Fluid-metering Equipment: Dump-type volume meters (separate or integral with separation equipment) are used most frequently. These meters are available with an impulse output per dump for data recording equipment.

Positive-displacement meters may also be used for fluid measurement. This type meter is more applicable to high volume rates. Flow rates through PD meters must be held within certain limits to insure accurate metering.

Emulsion metering requires sampling and storage of the sample in an individual container per well. A conventional manual shake out is required to correct metered fluid for oil and water percentages. Use of integrating BS&W Recorder, in conjunction with PD meter to automatically net out emulsion components has been occasionally used. Separation of oil and water and independent metering of each is considered most satisfactory where sufficient water cut is present in the emulsion.

Selection of well control equipment, manifold control equipment, and test metering equipment gives the basic system. To this must be added, if desired, automatic programming equipment, data recording equipment, and custody transfer means.

Automatic Programming: Previous phases have included automatic equipment in place of manual equipment. These items basically

FIG. 1 WELL CONTROL

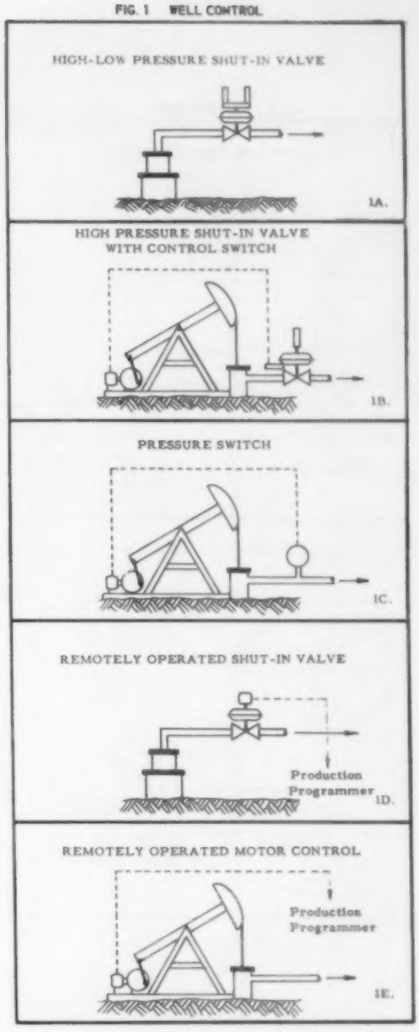


FIG. 2 MANIFOLD CONTROL

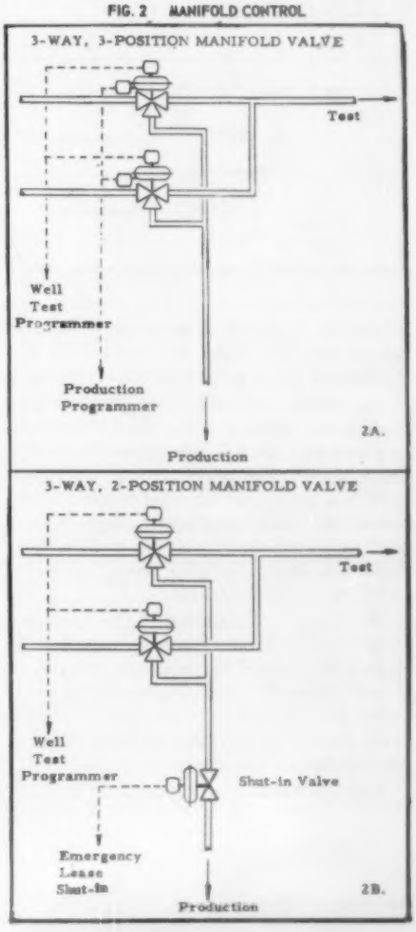
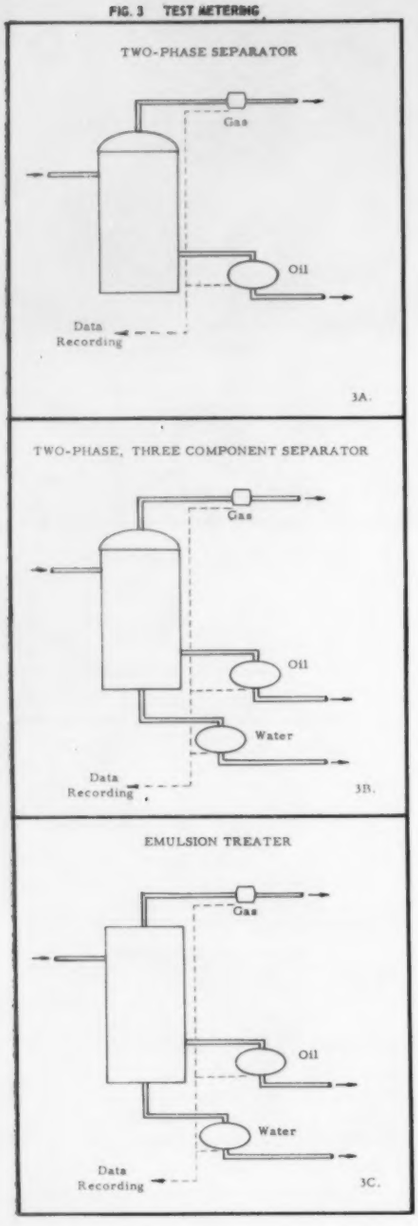


FIG. 3 TEST METERING



substitute for physical operation performed by a man. It might be noted that this equipment could still be manually operated.

Automatic controlling or programming equipment duplicates the thinking process required by a man. The complexity of automatic production programming, automatic well test programming, and related accessories has been overrated. These devices perform relatively simple and routine functions. Standard, "building block" programmers are readily available.

Automatic Production Programming (Figure 4A): Production programming describes the control of producing periods of a well. Basically, this programmer is composed of a group of time clocks, one per well. Producing periods are controlled by the clock.

The production programmer is connected to the 3-way, 3-position manifold valve or directly to the well control device.

If production programming is used in conjunction with automatic well test programming, the two controllers are simply interlocked so that well tests occur during producing periods of the well.

Automatic Well Test Programming (Figure 4B): Automatic scheduling and sequencing of well tests is the function of the well test programmer. This controller automatically tests each well in a sequence for a preset timed period. The programmer advances to the next well in the sequence after a well is tested for the timer period. Manual override and well by-pass switches are provided.

The well test programmer is connected to the test side of the manifold valve. This programmer also is connected to the data recording equipment to provide well identification. However, it is necessary to understand that the production programmer, well test programmer, and data recorder perform separate functions and should be considered as separate components. They are interconnected simply when common functions are performed.

Electric automatic programming equipment is most commonly used, primarily because of the flexibility available in data recording.

Data Recording (Figure 5): Selection of the method or methods of recording information from automatic well tests requires evaluation of record handling procedures. The use of the record, the levels where records are required, and the time delay that can be tolerated at each level receiving the record must be considered.

Multi-pen strip chart recorders can be used to log metering data and well identification vs. time on a strip chart. However, to obtain totalized data, the chart markings must be manually summed.

Conventional counters can store test meter impulses. One counter is required for each variable. Additional counters may be used to store data from several well tests. The disadvantages of this method is that only totalized volumes are obtained, production rate cannot be determined, and well identification is not positive.

Printing counters combine the best features of strip chart recorders and conventional counters without their disadvantages. Complete well identification, date, time and meter volumes are printed at start and end of the test period. Manual and periodic readings may easily be obtained. Carbon copy records may be useful. The printed record alleviates chance for error in transcription and eliminates time consuming manual record preparation. Automatic typewriters or adding machines with electrical data storage may also be used for preparing printed records.

Non-coded punch tape systems provide a record of identification data and time vs. metering data on a punched tape for automatic processing. This system allows production rate information to be obtained easily. A central translation unit converts non-coded tapes to conventional coded tapes. Supplemental information can be added to the summary printed record and coded tape. This system is less complex and less expensive than conventional punched tape systems.

Coded punch tape systems can also be used to record well test information. Data storage must be used with this technique increasing the cost over non-coded techniques. Well identification can also be more complex if supplemental data storage is not used at the central station.

Consolidation of local stations is possible by using multi-conductor cable to connect centrally located controls to several remote testing manifolds. This allows an intermediate station to be the operating point between the local and central stations. Recording methods follow essentially the same options as available at a local station.

Where distances between local stations and intermediate or central station exceed several miles, telemeteing techniques are applied where consolidation of operations is economical or necessary because of remoteness. Telemetering allows many pieces of control information to be conveyed over a limited number of wires or microwave channels. Metering data is usually stored electrically at the local station and transmitted "on demand" to the central station. The telemetering phase is considerably more expensive than any other recording phase.

Custody Transfer: Figures 6A, 6B, and 6C show three methods used to transfer the custody of lease oil to a transporter or purchaser.

Storage of crude oil in stock tanks is the most common method. Gauging the tank at start and finish of a run determines the volume transferred. Automatic tank switching can be applied to automatically sequence production from filled tanks to other available tanks in a battery.

Transfer of oil can also be done automatically by the use of automatic metering devices. This phase is referred to as automatic custody transfer.

Positive volume metering tanks or weir tanks are the common tank type units used. Rotary positive displacement meters are also available. The relative merits of the different systems has been debated, but it will suffice to say that either method can meter oil with accuracy equal to, if not better, than hand gauging. Generally tank type meters require less frequent calibration than PD meters. PD meters are available for higher capacities than tank type meters.

Economic Considerations: Justification for the use of automatic metering and controlling techniques is primarily based on savings obtainable in capital expenditures and operating costs. The final selection of the automation method and equipment is strongly influenced by the economics of the phases and total system.

The main considerations are:

a. Manpower reduction
b. Transportation savings
c. Reduction in facilities cost

d. Safety

e. Improved information.

Generally a combination of these factors is involved in an economic analysis. Other intrinsic savings may be viewed.

It is necessary to evaluate each phase of an automatic lease system in regard to its particular economics. Some phases can offer considerable savings, while other phases may be expensive and allow only small returns. If the economic study is not thorough and by phases, optimum return on the investment may not be obtained because of marginal expenditures. It is not necessary to convert an entire lease (or field) to total automatic operation. Automatic well control is not necessary prerequisite to automatic custody transfer; nor is telemetering a requirement in automatic well testing systems. An "all or nothing at all" attitude will not give optimum payout and usage.

Effective usage of lease automation equipment allows elimination or reduction of routine duties performed by operating personnel. With the elimination of repetitive tasks, the additional time available need not be limited solely to increasing the number of wells handled by the pumper. In many instances this time could be more profitable utilized in appraising producing capabilities and characteristics of the wells. The end result of this being the establishment of optimum operating procedures to achieve the maximum production for the least possible cost.

Further savings may be available in the processing of well test records by using automatic record processing equipment. However, before appreciable savings are possible, a large portion of the wells in an area must be eventually using automatic punched tape recording.

Well spacing, well production, remoteness, terrain, and climate are factors which effect the application of automatic lease systems. No formula is apparent to resolve these points into a rapid solution. However, no better guide exists in determining where automation is best applied than by examining operating costs.

Planning from the start in a new field or secondary recovery operation has real significance. Centralization of facilities from the start of a project and a total program for automation allows the maximum savings in capital expenditures and operating costs. When all factors are balanced out, an automatically operated centralized installation costs initially about the same as a manually operated, individual lease. The automatic lease system, however, will allow substantially greater payout over the life of the field.

This discussion has described only the commonly used and proven techniques and equipment. While it may be apparent that there are many factors and considerations in the selection of the optimum system, the problem is certainly not insurmountable.

Lease automation is not a panacea. It is an advanced tool to be used by industry in the ever pressing effort to reduce costs and increase operating efficiency. END

FIG. 4 AUTOMATIC PROGRAMMING

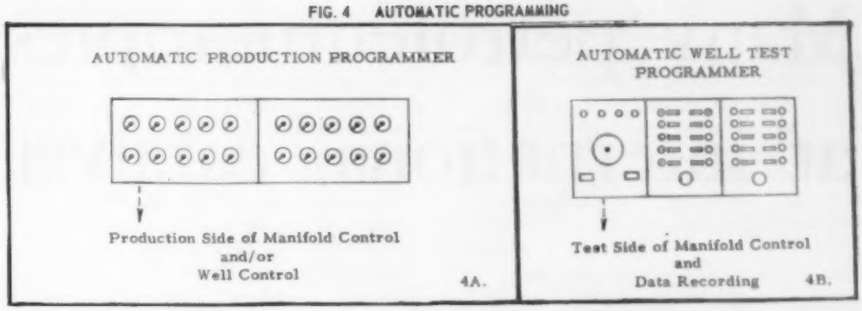


FIG. 5 DATA RECORDING

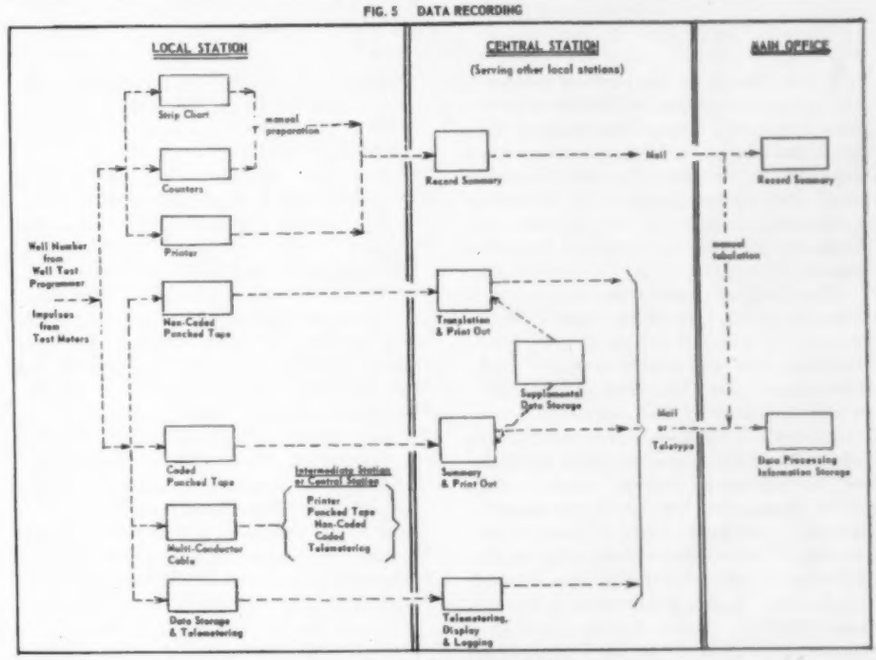
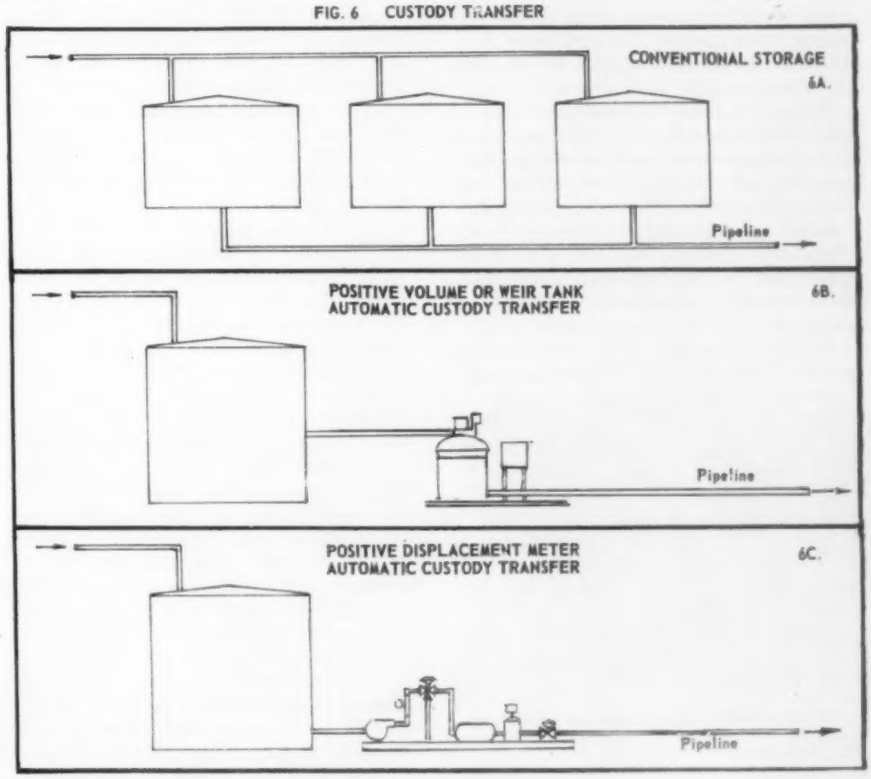


FIG. 6 CUSTODY TRANSFER



Many petroleum topics discussed at international catalysis congress

by Ernest Solomon*

A WIDE RANGE OF SUBJECTS of interest to the petroleum processing industry was covered during the Second International Congress on Catalysis in Paris, July 4-9, including catalytic cracking, paraffin isomerization, hydrogenation, catalytic reforming, other catalytic processes, chromia and iron catalysts, air pollution, and the theoretical aspects of catalysis.

The Congress met in the Maison de la Chimie. Presiding officers were Prof. M. Prettre, (University of Lyon), president of the executive committee, and Dr. Heinz Heinemann (M. W. Kellogg Co., New York), president of the Congress.

Six invited speakers were scheduled to address the plenary sessions: Prof. H. Theorell of Sweden on enzyme catalysis, Prof. N. N. Semenov of the USSR on chain reactions, Prof. R. P. Bell of Great Britain on isotopic effects in acid-base catalysis, Dr. Heinemann on the relationships between fundamental and applied research in catalysis, Prof. G. Natta of Italy on stereospecific catalysis, and Mr. M. Eugene Houdry of the USA on developments and trends in industrial catalysis. An address by Prof. Hugh S. Taylor of the USA was to close the Congress.

Except for some of the plenary sessions, the Congress was devoted almost exclusively to heterogeneous catalysis. Papers were grouped into sections on mechanism and kinetics, properties of catalysts, and applied catalysis. As is properly the case for an international congress, the major emphasis was clearly on the theoretical and fundamental aspects; only about one-sixth of the papers dealt with applied catalysis.

Nineteen countries were represented by papers. Statistics, although possibly uninformative unless balanced by indices of quality, are interesting: USA, 43; USSR, 20; France, 13; Great Britain, 13; Japan, 9; Netherlands, 9; Poland, 7; Germany, 6; Czechoslovakia, 5; Italy, 5. Two papers each represented the following countries: Canada, India, and the Union of South Africa; and there was one each from Belgium, Hungary, Israel, Turkey, and the United Arab Republic.

A total of about 150 papers were scheduled, with as many as three sessions being held simultaneously, during the six-day meeting. By comparison, at the first Congress—held in Philadelphia in September, 1956—about 80 papers were presented in five days.

At least half the papers presented at Paris last month were of interest to petroleum chemists. Every major refiner was expected to be represented, if not among the authors, at least in the audience.

Reviews of some 42 of the papers follow:

Catalytic Cracking. Silica-alumina cracking catalysts received detailed attention, more emphasis being placed on methods for characterising the catalyst than on the catalyzed reactions. Indeed, there was not a single paper on catalytic cracking as such.

Trambouze, Perrin, Weill, Barthomeuf and Prettre (France) presented evidence for an irreversible exothermic reaction on heating silica-alumina gels at 580°C. Steam lowered the temperature at which the phenomenon was observed. It was suggested that at around this temperature hydroxyls migrated to the surface and there neutralized, with liberation of heat, Lewis acid centers. Danforth (USA) studied the reactions of silica-alumina cracking catalysts with salt solutions, activity and acidity being determined before and after exchange. Structural inferences were drawn from the ion exchange data. Fischer and Sebba (South Africa) prepared a series of silica-alumina catalysts by vapor phase hydrolysis of the chlorides. The activation energy for the catalytic decomposition of formic acid over these catalysts was shown to be simply relatable to the acidity as determined by n-butylamine titration although the properties of a sample of commercial cracking catalyst did not fall on the correlation line.

Leftin and Hall (USA) and Webb (USA) measured the ultraviolet absorption spectra of chemisorbed olefins and paraffins on silica-alumina, deriving from these spectra confirmation that, in the chemisorbed state, hydrocarbons are present as carbonium ions. In a related study Peri (USA) reported an infrared study of the room temperature isomerization of n-butene on gamma alumina aerogel; no evidence was found for carbonium ions.

Panchekov (USSR) in the course of a generalized discussion on the kinetics of heterogeneous catalytic reactions, used several illustrative examples from the field of catalytic cracking. Of particular interest was a kinetic expression derived for the rate of coke formation. The effective or active surface area of the catalyst could be estimated from the constants of the rate equation; the effective area was about 3 to 10%, depending on the material cracked, of the total area as measured by methanol adsorption.

Paraffin Isomerization. There were surprisingly few papers on paraffin isomerization. Schriesheim and Khoobiar (USA) measured the relative rates of liquid phase isomerization and degradation of the various hexane isomers at 98F in the presence of an unspecified activated aluminum halide. The relative rates of isomerization were: 3-methyl-pentane, 10.7; 2-methylpentane, 3.2; 2, 3-dimethylbutane, 2.5; n-hexane, 1.0; 2, 2-dimethylbutane, 0.08. The ratios of maximum cracking rate to isomerization rate were: 2, 2-dimethylbutane, 10; n-hexane, 2; all other isomers, 1. It was shown that these relative rates can lead to transient states in which concentrations of individual isomers may exceed thermodynamic equilibrium. The kinetic data were interpreted in terms of a carbonium ion chain mechanism requiring that isomerization be first order in ion concentration, degradation of higher order.

Gray, Masse and Oswin (USA) studied the hydroisomerization of n-pentane at about 520F over a number of noble metals and their alloys, supported on fluorided eta-alumina. Isomerization activity decreased, and cracking activity increased, in the order: Pt, Pd, Ir, Rh; Ru and Re cracked without isomerizing. Pt-Ru and Pt-Re alloys exhibited maximum isomerization activity at about 15%. Ru or Re although Ru and Re alone had no activity; the optimum alloy catalysts were about 50% more active than the unalloyed Pt catalyst. Pt-Ir alloys displayed maximum activity at about 30% Ir, Pt-Os at about 30% Os.

Rabo, Pickert, Stamires and Boyle (USA) described studies on the hydroisomerization of n-pentane and n-hexane, between about 650 and 850F, over platinum supported on various synthetic zeolites. The decationized and polyvalent cationic forms of a 10 angstrom pore size 2.5 Si/Al ratio zeolite displayed isomerization activity. Zeolites of 1.2 Si/Al ratio were inactive.

Chromia Catalysts. Particular attention was paid to the structure of chromia catalysts, presumably because of their re-

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cently acquired importance in the low pressure polymerization of ethylene and propylene. Most of the studies were concerned with the characterization of chromia catalysts by physical means. Cossee and van Reijen (Netherlands) studied the oxidation state of various supported chromia preparations by means of electron spin resonance and magnetic susceptibility measurements. Careful and mild reduction was reported to lead to Cr^{5+}, Cr^{4+} or their mixtures; prolonged reduction lead to Cr^{3+}. The Cr^{5+}/Cr^{4+} ratio of supported chromia decreased with decreasing alumina content in a graded SiO_2-Al_2O_3 series. It was suggested that Cr^{4+} ions, or a combination of Cr^{4+} and Cr^{5+} ions, situated in the tetrahedral interstices of silica-alumina, are the centers active for polyolefin polymerization.

Pecherskaya, Kazansky and Voevodsky (USSR) also employed electron spin resonance to study supported chrome catalysts. Chromia-alumina was pictured as consisting of patches of Cr_2O_3 microcrystals in an Al_2O_3 base with additional isolated Cr^{3+} ions forming a two-dimensional solution on the surface. On SiO_2-Al_2O_3 there was evidence after reduction, for an intermediate oxidation state, suggesting CrO_2-$CrO_{2.4}$.

Rubinstein, Pribytkova, Afanasyev and Slinkin (USSR) combined magnetic susceptibility, x-ray diffraction, chemical analysis with catalytic studies in their study of a series of K_2O-Al_2O_3-chromia catalysts. They found evidence for Cr^{6+}. Bridges, MacIver and Tobin (USA) characterized a series of chrome-alumina catalysts by chemisorption of oxygen and carbon monoxide and by the activity of the catalysts for oxidation of carbon monoxide. There were two papers on reactions of hydrocarbons over chromia catalysts: Pines and Chen (USA) on the mechanism of hydrocarbon aromatization as deduced from studies on n-octane-1-C^{14}; Kim and Krieger (USA) on aromatization of n-heptane over chromia-silica.

Iron Catalysts. Several papers were prepresented on iron catalysts. Mars, Gorgeis and Zwietering (Netherlands) tested fourteen commercial iron oxide-chromium oxide catalysts used for the water gas-shift reaction: $CO + H_2O = CO_2 + H_2$. Activity was found to be directly proportional to surface area and independent of chromium content. Chromium acts as surface stabilizer, minimizing loss of surface area by sintering, rather than as a catalytic promoter.

Kölbel (Germany) studied the role of potassium as promoter for iron synthesis catalyst. Potassium acts as a structural promoter, influencing surface area and pore diameter; it also acts as a chemical promoter, enhancing chemisorption of carbon monoxide and inhibiting chemisorption of hydrogen. Kölbel, Englehardt, Hammer and Gaube (Germany) and Karn, Schultz and Anderson (USA) reported studies on the mechanism and kinetics of the Fischer-Tropsch synthesis reaction.

Hydrogenation. Probably the simplest of all catalytic reactions is that of hydrogen-dueterium exchange: $H_2 + D_2 \rightleftarrows 2\ HD$.

It is a measure of the state of catalysis theory that three papers were concerned with the details of this reaction. Gundry (Great Britain) studied the reaction over a variety of nickel and tungsten catalysts. In every case there was clear evidence for surface heterogeneity, only a portion of preadsorbed deuterium exchanging with hydrogen. Schwab and Killmann (Germany) also studied hydrogen-deuterium exchange over nickel; they concluded that the kinetic data did not fit the Eley-Rideal mechanism (reaction between a chemisorbed atom and a free or physically adsorbed molecule) although Gundry had presented qualitative arguments in favor of this mechanism. Boreskov and Vassilevitch (USSR) studied the exchange between hydrogen, deuterium and tritium on platinum. They also reported evidence of surface heterogeneity; their data also could not be explained in terms of the Eley-Rideal mechanism. The Bonhoffer-Farkas mechanism, involving simultaneous desorption and adsorption of two atoms, was considered applicable at about 300K, a special mechanism being required to explain results below 90K.

In view of the continuing disagreement on the mechanism of the simplest possible reactions of hydrogen, it is not surprising that the much more complex hydrogenation of ethylene is still being examined and explained. Matsuzaki (Japan) studied the reactions between deuterium and ethylene on nickel wire over the temperature range from —25C to —300C. The data were shown to be contradictory to the mechanism of Twigg and Rideal but to be consistent with the Horiuti-Polanyi mechanism postulating that chemisorbed ethylene reacts with a chemisorbed hydrogen atoms to yield chemisorbed C_2H_5 which then reacts with a second chemisorbed hydrogen atom.

In a related study, Hartog, Tebben and Zwietering (Netherlands) examined exchange and hydrogenation reactions of liquid benzene with deuterium on a Raney nickel catalyst. The rate of hydrogenation was given by $R = kC^{0.30}\ p^{0.64}\ \exp. -10{,}600/RT$, where C is concentration of benzene and p is pressure of hydrogen. The data were interpreted in terms of the Horiuti-Polanyi theory utilized by Matsuzaki for ethylene.

Mode of chemisorption is important in hydrogenation. Galwey and Kemball (N. Ireland) measured the dissociative adsorpton of simple aliphatic alcohols, ketones, ethers, amines and halides on Ni-SiO_2 catalyst. The reaction was measured by exchange of the dissociated hydrogen atoms with gaseous deuterium. At 0°C, oxygen-containing and nitrogen-containing compounds were adsorbed mainly on the support; there was little dissociative adsorption on nickel at 100C. The alkyl halides behaved much like hydrocarbons, dissociating readily to form stable species.

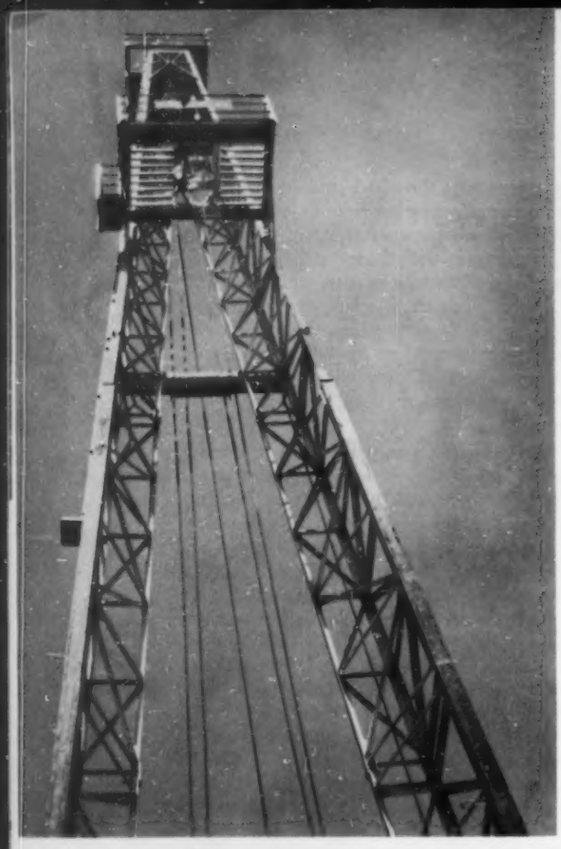
Selective Hydrogenation. Several interesting papers were presented on various phases of selective hydrogenation. Gaschke, Spector and Heinemann (USA) reported an instance of the effect of structure on hydrogenation; they had studied the selective vapor phase hydrogenation, over cobalt-molybdena-alumina catalyst, of 2-pentene in its mixtures with 2-methyl-2-butene. Because of a difference in energy of activation of about 3 kcal/mol, selectivity for hydrogenation of 2-pentene increased with decreasing temperature. At 49C, the rate of hydrogenation of pentene-2 was about twenty-fold greater than for 2-methyl-2-butene.

There were several papers on the selective hydrogenation of acetylenes to olefins. Bond, Newham and Wells (Great Britain) distinguished, in the selective hydrogenation of acetylenes in the presence of olefins, between a thermodynamic factor, which was determined by the relative extents to which the reactant hydrocarbons were adsorbed, and a mechanistic factor, which determined the ratio of the products formed. Data were given, and interpreted, for selective hydrogenation of acetylene over Al_2O_3-supported Pd, Rh, Ir, Pt and Pd-Ag catalysts; unlike the other catalysts, Ir did not give a well-defined two-stage reaction. The variation with hydrogen pressure, P, of the selectivity factor s was of the form, $1/(1 + s) = kP^x$, where x was an exponent between 0 and 1 and increased with temperature. Bond and Wells (Great Britain) studied the effect of mercury vapor on the poisoning of Al_2O_3-supported Pd for the hydrogenation of acetylene. Activity for ethylene hydrogenation was effected more than activity for acetylene hydrogenation. The results were explained in terms of a model in which it was assumed that the mercury acted by covering surface sites.

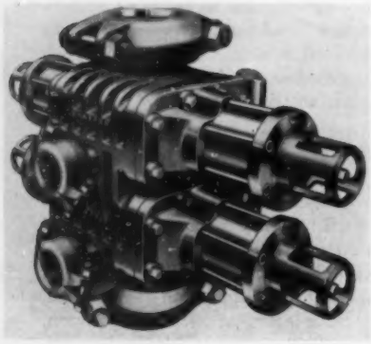
Hamilton and Burwell (USA) investigated the selective hydrogenation of dimethylacetylene over Pd-Al_2O_3 catalyst. In the steady state, the only product was cis-2-butene until all the dimethylacetylene had reacted. After all the methylacetylene had been hydrogenated, cis-trans isomerization occurred and hydrogenation to butane. Methyl sulfide acted as a selective poison, almost completely poisoning the hydrogenation of cis-2-butene. de Boer and van der Borg (Netherlands) discussed, in generalized terms, the mechanism and kinetics of the selective formation of an intermediate product for the case of two consecutive catalytic reactions. Selective hydrogenation was selected as an example for illustrative purposes.

Platinum Reforming. A group of papers of particular interest to petroleum chemists dealt with naphtha reforming and closely related catalytic processes. These papers will be reviewed in a forthcoming issue of WORLD PETROLEUM. Included in the review will be papers by McHenry, Bertolacini, Brennan, Wilson and Sielig (USA) on the nature of platinum dehydrocyclization, by Mills, Weller and Cornelius (USA) on the state of platinum in a reforming catalyst, by Pitkethyl and Goble (Great Britain) on the adsorption of benzene on supported platinum catalysts and by Pines and Chen

(Continued on page 83)



Looking up the mast, designed to provide capacity for economically drilling to 15,000 ft. All photos courtesy Standard Oil Co. of California, except view of blowout preventer.



Shaffer lightweight blowout preventer which saves approximately 55% in weight. The two compartments are unitized into one.

The rig was fabricated with special alloy steel legs. The subbase employs a high strength, corrosion resistant aluminum alloy.

Flying rig in Bolivia

AN UNUSUAL DRILLING RIG has been assembled in Houston, Texas, for use in airborne exploratory drilling operations in Central Bolivia, S. A. It will be used in the joint exploration program of Bolivia California Petroleum Co., a subsidiary of Standard Oil Co. of California, and Compania Petrolera Boliviana Shell Ltd., one of the Royal Dutch/Shell Group of Companies. The rig is being built for Loffland Brothers de Caracas C.A., the drilling contractor for Bolivical and Bolivishell. Loffland is furnishing personnel, rig, camp, transportation, and construction facilities.

Basic reasons for this special rig are the difficult accessibility of much of the area, the large distances involved, and the expense of operating a conventional rig with air transport. Much of central Bolivia is a low plains area subject to seasonal flooding. Terrain ranges from foothills to low swamps and from relatively dry and accessible to usually wet and inaccessible. Few roads exist in this area, and much of the exploration program will be conducted 200 to 300 miles from the supply source.

Basic rig specifications were prepared by Standard Oil Co. of California in consultation with engineers of Asiatic Petroleum Corp., of the Royal Dutch/Shell Group. Equipment is intended to be more economical to transport by air and capable of reducing exploratory drilling costs by efficient application of slim hole practices.

All equipment is easily disassembled into packages not exceeding 4,000 lbs weight for helicopter transport and not exceeding 8 ft by 8 ft by 28 ft size for cargo plane transport. The rig is designed to provide capacity for economically drilling 6⅛ in. hole to 15,000 ft with a tapered string of 4 in. and 3½ in. light weight drill pipe.

Rig Power—Diesel direct current electric power was selected as offering the advantages of flexible control and standby capacity along with portability and ease of rig up. Multiple units of model 640 PM Reliance Electric generators are provided to drive identical model 640 PM motors on the rig pumps and drawworks. Four 320 hp generators are installed with controls for an additional unit if required. Each generator is driven by two model NHRS-6-IP Cummins diesel engines. Generator unit skids will allow moving as a unit or breaking down into three packages for helicopter transport. The mounting of diesel engines, electric generators, mud pumps and motors was done by Unit Rig and Equipment Co.

Auxiliary A.C. power for rig, camp and standby is provided by three 150 KW General Electric generators driven by model NHRS-6-IP Cummins diesel engines.

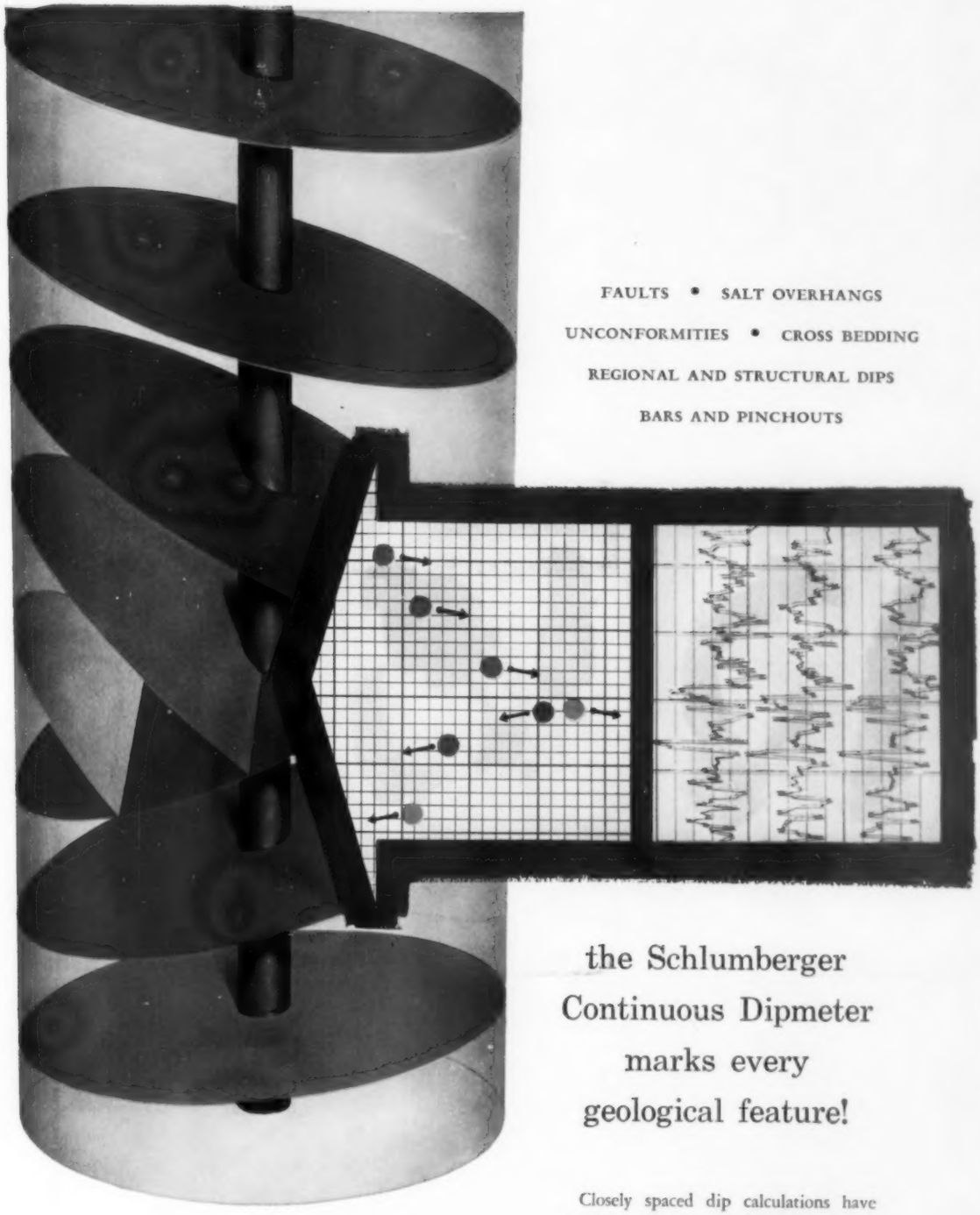
Drawworks—This unit is designed to handle the loads mentioned above with a minimum hook speed of 75 ft per min with maximum drill pipe load. Drawworks rating of 800 hp was specified and maximum generator engine horsepower demand for drawworks will be approximately 850 hp. An important consideration in this equipment is the requirement for easy disassembly to 4,000 lb maximum weight packages. The drawworks selected is the specially designed Wagner Morehouse model E 44 F.

Mast and Subbase—The mast and subbase have a rating of 350,000 lb hook load with concurrent pipe setback load of 150,000 lbs. The same considerations of portability and weight and size limitations were applied to the selection of this equipment. The mast furnished for this rig is the Ideco Junior Full-View model JFM-132 350 with special alloy steel legs. The subbase is a special design fabricated with a high strength, corrosion resistant alloy of aluminum. The subbase was designed by Ideco and Reynolds Metals Co. engineers utilizing aluminum magnesium alloy 5456 which exhibited superior corrosion resistance in tests in drilling muds.

Pumps—One of the most unconventional features of the airborne rig is the use of plunger pumps for the main rig pumps. It is anticipated that most of the time the rig will be drilling in 6⅛ in. hole and it will be desirable to maintain jet drilling conditions. It will also be necessary to drill larger hole to lesser depths. Conventional pumps are not designed to provide the low volume —high pressures needed for the first case. Three model PA 3 R Gardner Denver 4 x 8 triplex plunger pumps will be provided for mud pumps. These pumps produce the hydraulic characteristics required and offer the added advantages of light weight and portability. Measures taken to improve the performance of these pumps include a mud desander, suction supercharging pump and plunger packing lubrication system.

In operation, it is planned to use three pumps in parallel on top hole, two pumps on 9⅞ in. hole and one pump on 6⅛ in. hole. Controls have been provided for an additional pump if this proves necessary.

Drill Pipe—Light weight Youngstown drill pipe with light weight American tool joints will be used with the rig. 4½ in. 13.75 lb Grade E drill pipe with welded American open hole tool joints will be used for 9⅞ in. and larger hole. 3½ in. 9.50 lb Grade E drill pipe with welded American open hole tool joints will be used in 6⅛ in. hole to 10,000 ft. Below 10,000 ft in 6⅛ in. hole, a tapered string of 4 in. 11.85 lb Grade E and 3½ in. drill pipe will be used.



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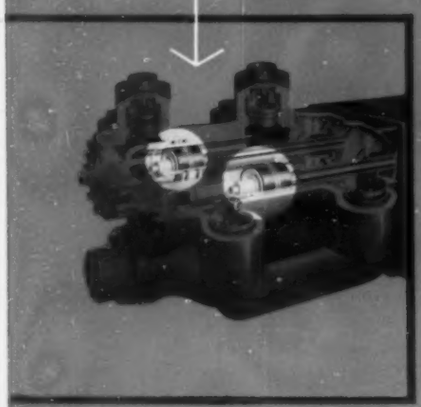


Take a good look at this Mission piston. Mission was first with this design, although today you'll see other pistons made to look like it. You see, the engineering advances that have gone into Mission pistons have made them the standard by which all others are judged.

Replaceable rubbers, long-life rubber compounds, special fabric backing, one-piece forged steel bodies, hardened piston flanges, close tolerances, wear groove in piston body flanges, API taper for piston bore, and easy and reliable snap rings and end plates are some of the specific reasons Mission pistons are superior.

The unique Mission guarantee, that Mission products will outperform any other products, is the big reason that removes all chance. You get the best only from Mission; so get only Mission—genuine Mission with the name on them—pistons. Play it safe!

MISSION MANUFACTURING CO.

MISSION MANUFACTURING CO., P. O. Box 4209, Houston, Texas, cable address "MISSCO" • export office: 30 Rockefeller Plaza, New York In the United Kingdom: MISSION MANUFACTURING CO., LTD., 1 Hanover Square, London W. 1 England • cable address "MISSOMAN"

69—500

Rig Piping and Tankage—The criteria applied to equipment selection has been used throughout the rig piping, mud circulating system and tankage. Aluminum piping has been used on low pressure service such as water and mud suction. Aluminum mud ditches, tanks and equipment skids were fabricated by Unit Rig & Equipment Co. All aluminum used in the rig is alloy 5456 to simplify repairs and material storage. All rig piping was fabricated by Joe Stine.

Fuel and water storage will utilize Goodyear rubberized fabric tanks and one of the mud storage tanks is aluminum frame with Goodyear rubberized fabric liner.

Evaluation Equipment—Light weight portable logging units will be provided. A Schlumberger airborne electrical logging unit will allow making conventional wireline surveys such as electrical logs, acoustic logs and taking sidewall samples. An especially designed Exploration Logging Co. drilling fluid and cuttings analysis unit will accompany the rig. This unit has up to date gas chromatographic equipment for use in continuously analyzing the mud effluent for hydrocarbon content. On-location core analysis is also provided.

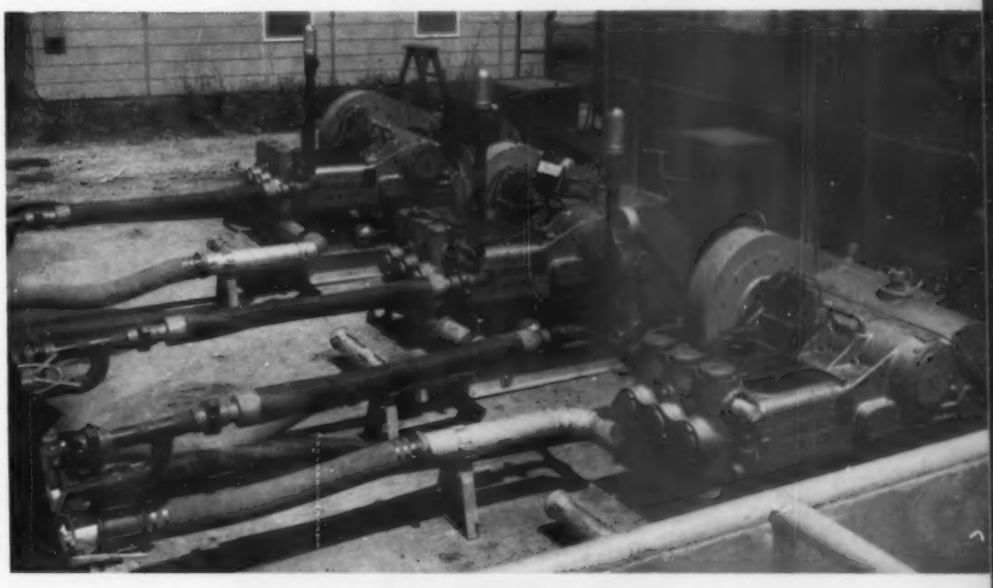
Camp—A complete portable camp is furnished with accommodations for 58 men. Living, eating and recreation quarters are air-conditioned. These units were built by Lee Const. and Portacamp and are designed to disassemble into easily transported packages.

Transportation Equipment—It is planned to transport the rig and supplies usually by air. If conditions at the drilling sites permit, air strips will be built and transport planes used to move the equipment and supplies. Two C-82 planes will be used on the initial rig up. If construction of an air strip is impractical at some location, helicopters will be used from the closest air strip to the location.

Handling of equipment and supplies from plane to rig site will be by tractor with tail boom and forklift trucks. Supply center for this airborne operation will be the Santa Cruz Airport.

The Bolivia airborne rig is one of the most compact and portable rigs of this capacity assembled to date. The weight of the complete drilling rig less pipe, supplies and camp is under 400,000 lbs or about half that of a comparable horse-power conventional rig. This weight saving has been accomplished without sacrificing rig efficiency. The complete rig including all accessories approximates an investment of 1¼ million dollars which is about the cost of a comparable conventional rig. END

Fuel and water are stored in Goodyear rubberized fabric tanks. Coated fabric mud tanks also were used.



Light weight, portable mud pumps are three Gardner Denver 4 x 8 triplex plunger type units.

Dual shakers, sand trap and desander are made of lightweight alloys.

SHAFFER
Develops Amazing New Lightweight BLOWOUT PREVENTERS for Bolivian Airborne Operations

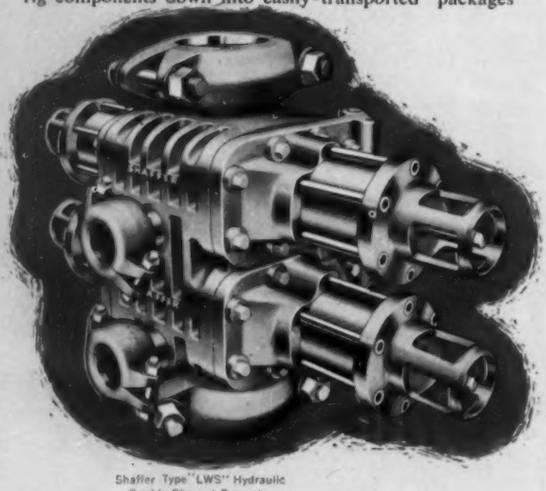
A joint venture of Bolivia California Petroleum Company, a subsidiary of Standard Oil Company of California, and Compania Petrolera Boliviana Shell, Ltd., one of the Royal Dutch-Shell group of companies, formed to carry out an extensive exploration program in the interior of Bolivia, South America, has attracted widespread interest because of the unique manner in which the program is to be developed.

A complete drilling rig—especially-designed for *airborne* exploratory drilling operations—has been built for Loffland Brothers de Caracas, C. A., the drilling contractor who will supply personnel, rig, camp, transportation and construction facilities for the program.

The airborne nature of the operations was decided upon only after careful evaluations to determine the most efficient and economical method of reaching the proposed development area. Roads are virtually non-existent and the area is subject to seasonal flooding that further complicates operations.

Lightweight, Easily-Transported Units

Key to the airborne program has been breaking the normal rig components down into easily-transported "packages"



Shaffer Type "LWS" Hydraulic Double Blowout Preventer 6"—Series 1500

that weigh no more than 4000 pounds each (for helicopter transport) and are no larger than 8′ x 8′ x 28′ (for cargo plane handling).

To avoid complex assembly problems at the rig-site, it was decided that blowout prevention equipment should be transportable as a complete unit, if possible—an assignment that posed major difficulties because normally-used blowout preventers with the required pressure rating weigh some 5700 pounds per unit, well above the 4000-pound weight limitation.

It was Shaffer—already experienced in the field of lightweight pressure control equipment through development of its Type "LWS" Blowout Preventers—that came up with the solution...

▶ **A new 6"—Series 1500 Shaffer Type "LWS" *Double* Blowout Preventer unit with 7-1/16" Bore and 5000 PSI *Working* Pressure (10,000 PSI *Test* Pressure) that weighs only *2610* pounds, complete!**

This Preventer has all the features and pressure-handling abilities of equipment weighing over 5700 pounds—yet weighs *less than half as much!*

▶ **Another Shaffer Type "LWS" *Single* Blowout Preventer developed for this project (a 10"—Series 900 Gate) has an 11" Bore, a 3000 PSI *Working* Pressure (6000 PSI *Test* Pressure)—all with a *total* weight of *2100* pounds (compared with the almost 4000 pound weight of comparable equipment heretofore available)!**

Full Range of Features

These new Shaffer developments are, in no sense, "stripped down" versions of heavier equipment. They are a continuation of the Shaffer program of developing lightweight, high-pressure Blowout Preventers and include all the well-known Shaffer advancements such as **"Swinging END-Opening" Doors** for quick, easy ram changes... **Positive "In-Line" Ram and Piston Design** that eliminates yokes, levers and other complicated assemblies... **Completely Enclosed Design** with no exposed operating parts... *and many other features found only in Shaffer Preventers.*

Important Transportation Savings!

If your drilling operations involve considerable transportation of equipment, it will pay you to investigate these new Shaffer Type "LWS" Preventers for *your* operations. In many cases, savings in transportation cost *alone* will more than pay the moderate cost of equipment!

See your nearest Shaffer representative for complete details on Shaffer's new Type "LWS" Preventers. Or write direct!

API Size	Bore	Working Pressure	Test Pressure	Weight, Complete
6"—Series 1500 "Double" Gate	7⅛"	5,000 PSI	10,000 PSI	2,610 lbs.*
10"—Series 900 "Single" Gate	11"	3,000 PSI	6,000 PSI	2,100 lbs.**

***A 55% saving in weight,** compared with normally-used equipment.
****A 46% saving in weight,** compared with normally-used equipment.

The new Shaffer Type "LWS" Preventers are available with Studded Flanges or Bolted Flanges... or with Hubs for Clamp-Ring Connections. They are also available with a wide selection of outlets!

37 years OF OIL TOOL LEADERSHIP

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HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT - FISHING TOOLS THAT EXCEL

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HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Shaffer Tool Works, 6201 South Shields Boulevard
FARMINGTON, NEW MEXICO, Shaffer Tool Works, Post Office Box 546
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 827
HOUMA, LOUISIANA, Shaffer Tool Works, 500 Fifth Avenue, New York, N.Y., U.S.A.
EXPORT SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N.Y., U.S.A.
IN CANADA: Shaffer Western Hemisphere, Inc., 5823 103A Street, Edmonton, Alberta.

Here's how one operator

SAVED 5 DAYS RIG TIME

with new Johnston tool!

"The Johnston Selective Zone Tester saved us five days rig time!"

Mr. Ernie Walker,
Drilling Superintendent,
Calvert Drilling Co.

The Jordon #1 was drilled by Calvert Drilling Company in Dewey County, Oklahoma and bottomed at 11,000 feet.

Drilling the well accomplished only part of the job. Now it became necessary to evaluate all possible producing zones and complete this well if it proved commercially productive. Just as during drilling operations, any delay in evaluation is costly. An idle rig, inoperative tools, equipment breakdown, needless action—all mean lost dollars.

The job of determining subsurface formation conditions was given Johnston Testers. **A total of nine Selective Zone Tests were run:**

Test interval—9534 to 9550 feet. Dual packers top and bottom. Used Johnston Selective Zone Anchor. Good test! Released tool, picked up 8 feet to interval 9526 to 9542 feet. Re-set tool. Another good test!

Test interval—9564 to 9685 feet. Dual packers top and bottom. Used Johnston Selective Zone Anchor. Formation failed to support mud weight. **Picked up tool and re-set seven times at different intervals.** Anchor worked perfectly, did not slide at any time!

The ability to set, release and re-set the Selective Zone Anchor allowed testing of many zones with just one trip in the hole. Extra time was saved since long tailpipe did not have to be run.

Selective Zone Testing with the new "CO" Combination Shut-In Hydraulic Tester and the new Selective Zone Anchor can save you money, too! Write Johnston Testers and learn why you get more from a Johnston Test!

Please send me descriptive literature and a new Johnston catalog.

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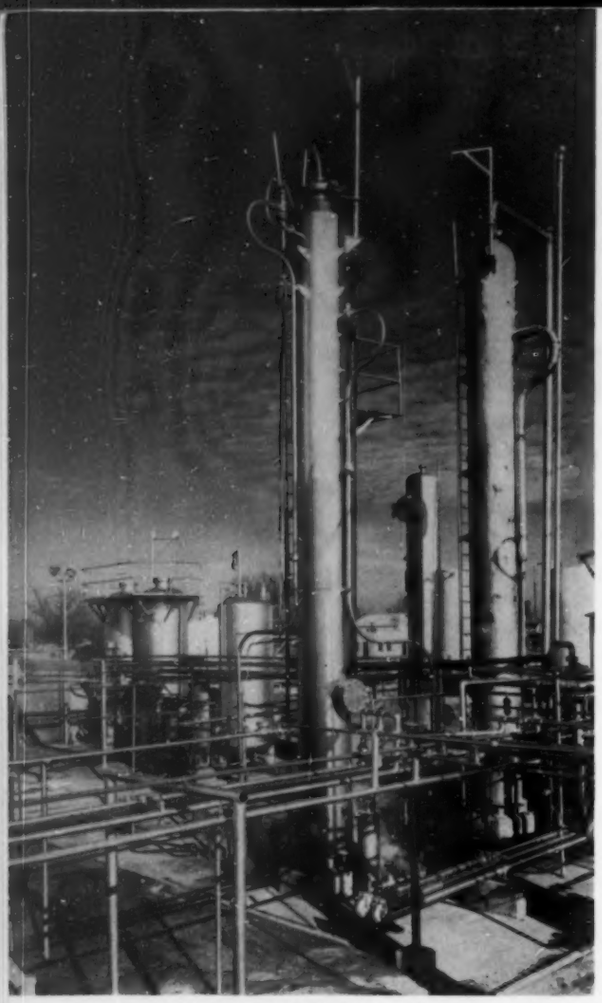
TITLE_____

COMPANY_____

ADDRESS_____

JOHNSTON TESTERS, INC.

P. O. Box 98 Houston 1, Texas



Merox process unit at Pana, Ill., refinery of Pana Refining Co. Tall vessels in foreground are extractor (left) and regenerator (right). Sweetening section comprises three shorter drums at left in background.

Merox treating today ~ nearly 100,000 b/d

LESS THAN ONE YEAR after its initial announcement, the new low cost catalytic treating process for gasolines, jet fuels, kerosine and light distillates developed by Universal Oil Products Co. and tradenamed "Merox," has already been widely installed and is continuing to gain refiners' approvals.

Installed and operating Merox* units now total about 30, representing a design throughput capacity rapidly approaching a total of 100,000 b/d. Individual units range from 150 to 12,000 b/d. However, there is no apparent limit to the size, and several much larger units are nearing the start-up stage. The biggest unit designed thus far is of 40,000 b/d capacity; it has not yet been installed.

Initial investment and operating costs have been found to vary with each specific installation. One new 2,500 b/d unit cost $50,000 to erect ($20 per b/d of capacity). On the other hand, a unit of 13,000 b/d now in the design stages has been estimated on a preliminary basis to cost only about $150,000 ($11.53 per b/d of capacity). Operating costs for the proposed 40,000 b/d unit have been estimated at 0.8 to 1¢ per bbl.

Virtually all the operating units so far have been conversions from existing equipment. Only one has been a completely new installation. However, several new units now are in the design stage. For the most part, conversions have been to replace Doctor and copper treaters and/or inhibitor sweetening, or in addition to inhibitor sweetening.

The new process, described in complete detail late last year in WORLD PETROLEUM,** is a combination of mercaptan extraction and sweetening, either of which can be carried out independently when desired. The combined operation is applicable to all gasoline and lighter boiling range streams. The sweetening step is applicable to many jet fuels and kerosines.

Refiners have found the Merox process attractive not only because it overcomes many inherent disadvantages of such conventional treating processes as copper or Doctor sweetening but because they can quickly and easily convert existing treating equipment to Merox. For example, one commercial unit combining extraction and sweetening used a converted steam regenerated caustic scrubber and a copper sweetening unit. The final Merox unit eliminated a number of the vertical vessels, all heat exchangers and the three copper sweetening unit reagent towers. The single addition was a disulfide separator and this, too, was made of an existing vessel. A few piping changes were all that were necessary to complete the conversion.

Some recent performance reports on several of the current installations are given in the following brief reports.

One midwestern company with a small (4,000 b/d) refinery including thermal cracking and Platforming,* was the first to install a commercial Merox unit. It is successfully extracting 90% of the mercaptans from a mixture of light straightrun and full boiling range thermally cracked gasoline that contains from 0.1 to 0.12 wt-% mercaptan sulfur. The sweetening section of the unit employs a solid bed catalyst.

At one Canadian refinery, a 1,200 b/d Merox unit with solid bed sweetening is providing a substantial reduction in the mercaptan sulfur content of a gasoline type (JP-4) jet fuel, going from 0.015-0.020 wt-% in the charge to well below 0.001 in the product. The feed has an API gravity of 51.2 at 60 F., an initial boiling point of 176 F., 50% point of 310, and end point of 390 F. (See Table 1, Case I).

A western USA refiner has a 2,000 b/d unit that represents what was probably the easiest installation of this straightforward Merox design. Utilizing existing equipment wherever practicable, this company had the unit completed and in operation in less than a month from the time the decision for a go-ahead was made.

(*Continued on page 64*)

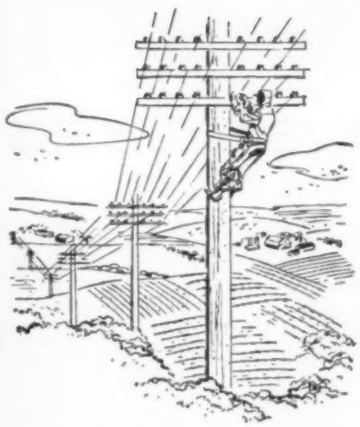
*Registered trademark.

**"A New Low Cost Treating Process," by K. M. Brown, W. K. T. Gleim and P. Urban, WORLD PETROLEUM, November, 1959, pp. 86-92.

Table 1—Typical Commercial Results with Merox Treating

Case	I	II		III	IV	V	VI	VII
Type of Merox	solid bed	solid bed		liq/liq	liq/liq	solid bed	solid bed	solid bed
Type of feedstock	JP-4	Visbreak gasol. (15%)	Str.-run gasol. (85%)	FCCU gasol.	FCCU gasol.	Light naphtha	Heavy naphtha	Thermal crack & LSR gasol.
Feed API gravity	51.2	64.5	58.6	61	55.8	66.4	60.6	66
Feed RVP, psi.	*	15	3.1	6.7	*	*	*	13.5
IBP, °F	176	103	139	106	115	98	130	93
10%	253	150	183	135	141	136	200	118
50%	310	235	237	199	224	220	274	199
90%	358	303	296	320	369	320	328	322
E.P., °F	390	332	356	386	445	354	362	368
Feed RSH, wt-%	0.015–0.020	0.06	0.002	0.005	0.022	0.023	0.034	0.09
Feed blend RSH, wt-%		0.0272						
Product RSH, wt-%	<0.001	0.0001–0.0004		0.0003	*	*	*	0.0003
Product Doctor test	**	neg.		neg.	neg.	neg.	neg.	***

* Not reported.
** Meets jet fuel specifications.
*** See text.



Stretching across hills, plains, rivers, from border to border, and from country to country, these wires hum with activity. People speak with friends and relatives ...business operates faster. Today there are over 70 million phones in use in the United States serving homes and industry. They are a vital part of our everyday life.

there's more to Cities Service than meets the eye!

It's easy to make a telephone call. Actually it could not be done without the help of thousands of people, and a vast network of facilities.

In New York City where there are over 4,000,000 telephones, the job requires more than 11,000 operators, and over 50,000 other employees. Meanwhile, 7,000 scientists, engineers, and technicians in the New York metropolitan area are seeking ways to improve the telephone system.

That's about the way it is, too, with the petroleum industry. Drive into one of those familiar green and white Cities Service stations and simply say, "Fill 'er up." In minutes you are off with a tankful of high quality gasolene.

To make that possible, thousands of skilled people work around the clock, on five continents, utilizing the most modern facilities of exploration and production, transportation, refining, research and marketing. The investment in these facilities has exceeded a billion dollars... and many millions of dollars more are being spent every year to expand and improve them.

Only in this way can America be given what it needs for progress—more jobs and better petroleum products.

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V-12 DI

COST LESS...WEIGH LESS...E

Cummins VT-12 Diesel Electric Drilling Unit

Max. h.p.	600 at 2100 rpm
Net cont. h.p. rating	435 at 1800 rpm
No. of cylinders	12
Bore and Stroke	5⅛" x 6"
Displacement	1486 cu. in.
Compression ratio	13.5 to 1
Generator (General Electric)	GT-602A

CUMMINS DIESEL INTERNATIONAL LTD.

(A wholly-owned subsidiary of Cummins Engine Company, Inc. Columbus, Indiana, U. S. A.)

Main Office: NASSAU, BAHAMAS—Cables: CUMNAS

European Office: ZURICH, SWITZERLAND—Cables: CUMZURI

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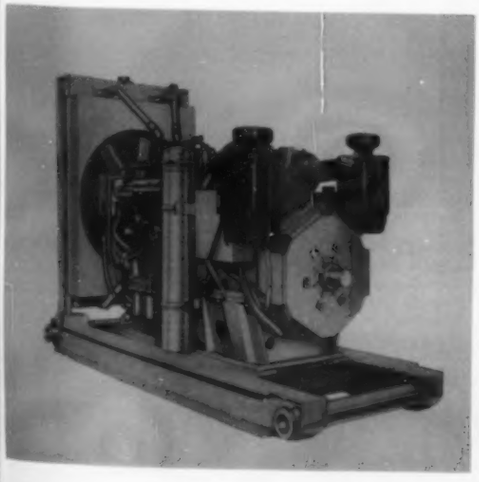


You can purchase a Cummins V-12 power unit for ⅓ the cost of comparably rated medium speed (1100-1300 rpm) diesel engines for either torque converter or electric drilling rigs. You also get the quality and features that have made Cummins world famous.

Cummins V-12 Diesel drilling units weigh approximately 40% less per h.p. delivered than medium speed engines of comparable rated h.p. This means a high degree of portability permitting extra savings in lighter equipment—faster move and rig-up time. Choose from two models—the 450 h.p. NVH-12 or the 600 h.p. VT-12. Either model delivers the low-cost dependable performance that means more profit!

Cummins Engines and parts manufactured in the U.K. and U.S.A. are available from more than 700 sales and service points and 121 countries throughout the world.

CUMMINS

Merox Treating Today

(*Continued from page 60*)

This unit is the so-called liquid/liquid type, in which the catalyst is in solution in caustic soda. Mercaptan sulfur content of the feed, a straightrun gasoline serving alternately as jet fuel component and as a reformer charge stock, is reduced from 0.009 wt-% to Doctor sweet 0.0003 wt-% or less. Catalyst consumption is 1 lb. of catalyst per 18,000 bbls.

At another Canadian refinery, a 500 b/d solid bed Merox sweetening unit is operating on a blend of visbreaker and straightrun gasoline in which the mercaptan sulfur is running at 0.0272 wt-%. The product contains 0.0001-0.0004 wt-% mercaptan and is Doctor sweet. (See Table 1, Case II).

There are two Merox units at another North American refinery. One is a 2,200 b/d liquid/liquid type sweetener operating on a pentane cut and taking it down from 0.04 wt-% mercaptan sulfur to Doctor sweet. Catalyst consumption is 1 lb. of catalyst per 18,000 bbls, but has ranged from a low of 1 lb of catalyst per 3,000 bbls (during the initial run when about 80% of the catalyst was inadvertently lost) to a high of 1 lb of catalyst per 77,000 bbls.

The other unit at this plant is also liquid/liquid and is handling 6,000 b/d of full boiling range, fluid catalytically cracked gasoline, reducing the mercaptan content from 0.005 wt-% to 0.0003 wt-% (Doctor sweet). The FCC gasoline has an API gravity of 61, initial b.p. of 106 F., 10% at 135, 50% at 199, 90% at 320, end point of 386, and an RVP of 6.7 psi. The Merox unit was relatively easy to install since it used the same equipment that had been in use for caustic washing to remove acid oils. Provision was made for catalyst and air addition. (See Table 1, Case III.)

The Merox process is providing one Western refiner with a Doctor sweet, thermally cracked C_5-C_6 cut; previously, he did not attain Doctor sweet quality at all. The Merox unit, a 750 b/d, liquid/liquid sweetening type, is producing a Doctor sweet product from a charge stock containing 0.073 wt-% mercaptan sulfur. The unit is a conversion of existing equipment.

In another western USA plant, an existing Doctor unit was converted to Merox liquid/liquid sweetening. This is a 3,000 b/d unit and has been in operation for over six months. The feed is FCC gasoline having a mercaptan content of 0.022 wt-%; the product is Doctor sweet. (See Table 1, Case IV.) The Merox unit has permitted a reduction of inhibitor consumption at this plant.

A somewhat more complex operation is that employed successfully by another midwestern refinery. This operates on a 50-50 blend of light straightrun and coker gasoline at 6,000 b/d. Coker gasoline goes through the extraction section of a steam stripped regenerative caustic scrubber and then joins with light straightrun in flow through a liquid/liquid sweetener. Mercaptan content of the coker gasoline is reduced from 0.05 to 0.015 wt-%. The light straightrun charge contains 0.005% mercaptan. The blended material comes out Doctor sweet. Plans are well along to use Merox regeneration instead of steam stripping in the caustic scrubber.

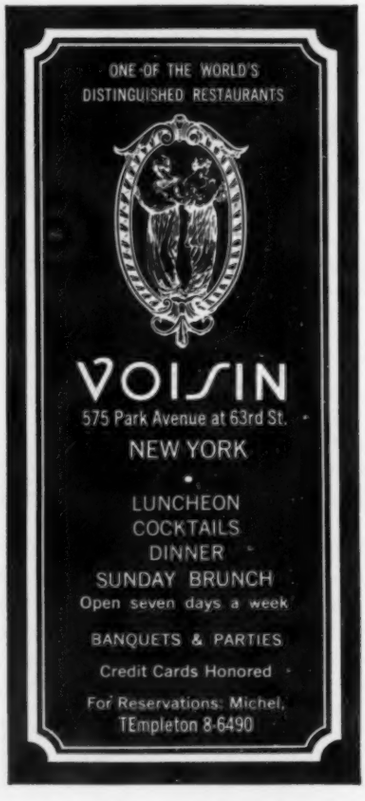
Another operation on JP-4 type fuel is attaining Doctor sweet product, charging two stocks in blocked out operation: a light naphtha and a heavy naphtha, having mercaptan contents of 0.021 and 0.034 wt-%, respectively. The Merox unit in this refinery is a solid bed treater. (See Table 1, Cases V and VI.)

A complete Merox unit (extraction and solid bed sweetening) of 1,700 b/d design capacity at one North American refinery is taking thermally cracked and light straightrun gasoline from a mercaptan content of 0.09 wt-% down to Doctor sweet, or as high as 0.003% which is as low as this refiner requires. This unit too was rebuilt from existing equipment. (See Table 1, Case VII.)

Even the more highly-branched, higher molecular weight mercaptans in kerosine can be successfully reduced. One commercial unit, a standard liquid/liquid sweetener, is reducing the mercaptan content of a 550 F end point kerosine from 0.006 wt-% to Doctor sweet.

Acknowledgment

The preceding article is based on information supplied WORLD PETROLEUM by Universal Oil Products Company. END



WORLD ROTARY RIGS DRILLING

(Excluding Communist countries)

Country	July 1 1960	July 1 1959
North America		
Canada	157	152
United States	1,771	2,284
	1,928	2,436
Latin America		
Argentina	119	80
Bolivia	15	17
Brazil	62	54
British Honduras	1	1
Chile	5	4
Colombia	20	17
Costa Rica	1	1
Puerto Rico	1	0
Cuba	0	4
Dominican Republic	1	0
Ecuador	1	4
Guatemala	2	1
Mexico	139	119
Peru	13	10
Trinidad	32	34
Venezuela	43	105
	455	451
TOTAL WESTERN HEMISPHERE	2,383	2,887
Europe		
Austria	23	34
British Isles	6	6
France	35	50
Germany	101	141
Italy (excl. Sicily)	42	36
Netherlands	6	3
Sicily	9	6
Spain	7	3
Switzerland	0	0
Yugoslavia	22	16
	252	295
Middle East		
Abu Dhabi	1	0
Bahrain	1	1
Egypt	10	4
Iran	16	9
Iraq	8	9
Israel	2	4
Jordan	1	1
Kuwait	3	6
Muscat & Oman	2	2
Neutral Zone	4	6
Qatar	1	1
Saudi Arabia	3	3
Syria	3	1
Trucial Coast	1	0
Turkey	14	6
	70	53
Africa		
Algeria (OCRS)	47	38
Angola	4	4
Belgian Congo	1	1
Gabon	4	4
Ivory Coast	1	1
Kenya	1	0
Libya	33	15
Madagascar	1	3
Middle Congo	1	1
Morocco	2	2
Nigeria	6	9
Senegal	6	5
Somalia	2	1
Somaliland Protectorate	1	1
Tunisia	2	2
	112	87
Far East		
Australia	7	6
British Borneo	6	2
Burma	6	3
India	9	6
Indonesia	7	16
Japan	15	17
New Guinea	1	1
New Zealand	1	1
Philippines	3	2
Taiwan (Formosa)	7	6
Timor	1	1
	63	61
TOTAL EASTERN HEMISPHERE	496	496
TOTAL WORLD	2,879	3,383

CB&I specializes in building refinery structures
Fourteen miles north of Sao Paulo, Brazil, at Capuava refinery, stands one of the largest Thermofor Catalytic Cracking Units ever built. The reactor, kiln, surge tank, catalyst storage tanks and main fractionator tower were fabricated by CB&I and erected by Chicago Bridge Construcoes Ltda. Six 150,000-barrel tanks for the storage of crude oil and a 10,000-barrel Hortonsphere were also built by CB&I.
CB&I specializes in building refinery structures to the most rigid specifications . . . and offers the coordinated services of a world-wide organization. Experienced CB&I erection crews are based in your area . . . ready to go to work on your job . . . when you need them. Write our nearest office for details.
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1—The most significant change in tool joint design in 20 years. The new "beefed up" pipe end on Reed Super Shrink-Grip joints, designed particularly for today's faster rotary speeds and greater weights.
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3 more reasons to run REED

There are many reasons you should choose Reed Tool Joints. The three illustrated here are prime examples of the extras you get when you buy Reed. The results of thirty-five years' experience in designing, researching, and manufacturing tool joints make every Reed Tool Joint you buy the very best of its type.

When you buy your next string, remember this—All Reed Tool Joints bear the "Mark of Quality," your assurance that you have the joints that will outlast any others!

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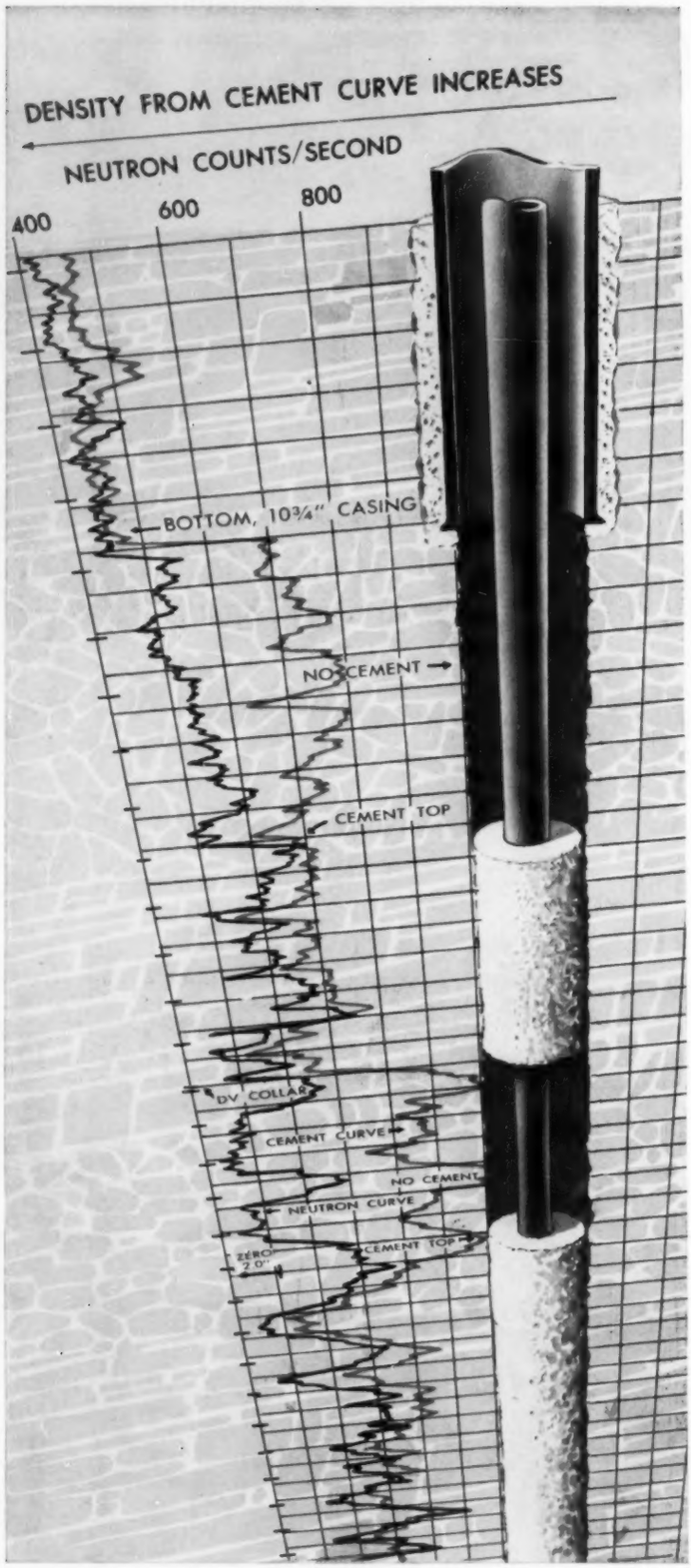

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How To Minimize Production Costs

(Continued from page 47)

the percentage of total time that the drill is rotating on bottom will increase footage and reduce the over-all drilling time per well. Maintenance of the most advantageous rate of rotation, bit pressure, drill column torque and volume and pressure of the circulating fluid for the particular type of formation being drilled will assure the maximum rate of progress. Changes in practice that result in reduction of time spent in "rigging-up," disassembling and moving from one location to another, round-trip time necessary in changing bits, delays occasioned by time spent in cementing, running casing, coring, surveying, logging, drill-stem testing, water exclusion and well completion will prove fruitful in further reductions in drilling cost.

While it is doubtless advantageous to secure all possible information concerning the formations penetrated in the course of drilling and to complete wells by technics that will enable them to produce as efficiently as possible, it seems probable that in many cases more time and money are spent in these operations than results will justify. Intelligent choice by competent engineers of the more dependable formation evaluation and well completion technics will often provide all of the essential information and assure production efficiency of the wells at lower per-well cost. Expensive mud additives may add greatly to the cost of drilling fluid. Perhaps some cheaper mud formula will be good enough or will permit of achieving the same result or one almost as good as the more expensive fluid.

Automatic Controls in Drilling Operations. The modern rotary drilling rig incorporates automatic devices that perform many operations that formerly required close manual control. Weight indicators and automatic feed devices maintain constant bit pressure and tend to reduce footage costs. Drilling recorders, tachometers, torque indicators, stroke counters and pressure gauges assure optimum performance of the drilling rig. Automatic slips incorporated in the rotary table and tong torque instruments greatly assist in "making-up" and "breaking-out" tool joints. Special equipment, as yet used only experimentally, mechanically accomplishes the entire operation of disconnecting a column of drill pipe, stacking it in the derrick, and reinserting it in the well.

Reduction of Unit Petroleum Cost by Use of Special Methods of Well Completion. Certain methods of well completion are designed to increase the rate of oil production or secure a higher ultimate recovery, either of which will lead to lower unit production cost. Thus, procedures involving acid treatment of carbonate reservoir rocks, gravel-packing with hydraulic formation of well cavities within the reservoir rock, hydraulic formation fracturing and well "shooting" offer means of increasing the rate of oil recovery and in many instances of actually increasing the ultimate recovery. However, these procedures involve expenditure of considerable additional capital and careful studies must be made to determine whether or not they will "pay out" within a reasonable time and actually yield oil at lower unit cost than would result if they were not used. Intelligently applied, they usually prove advantageous.

Similar considerations apply to programs involving recompletion of wells or extensive clean-out operations following several years of production. These operations may also prove to be expensive, but if they offer promise of increasing the rate of production or ultimate recovery of the wells sufficiently to reduce the future unit production cost, they will be of interest.

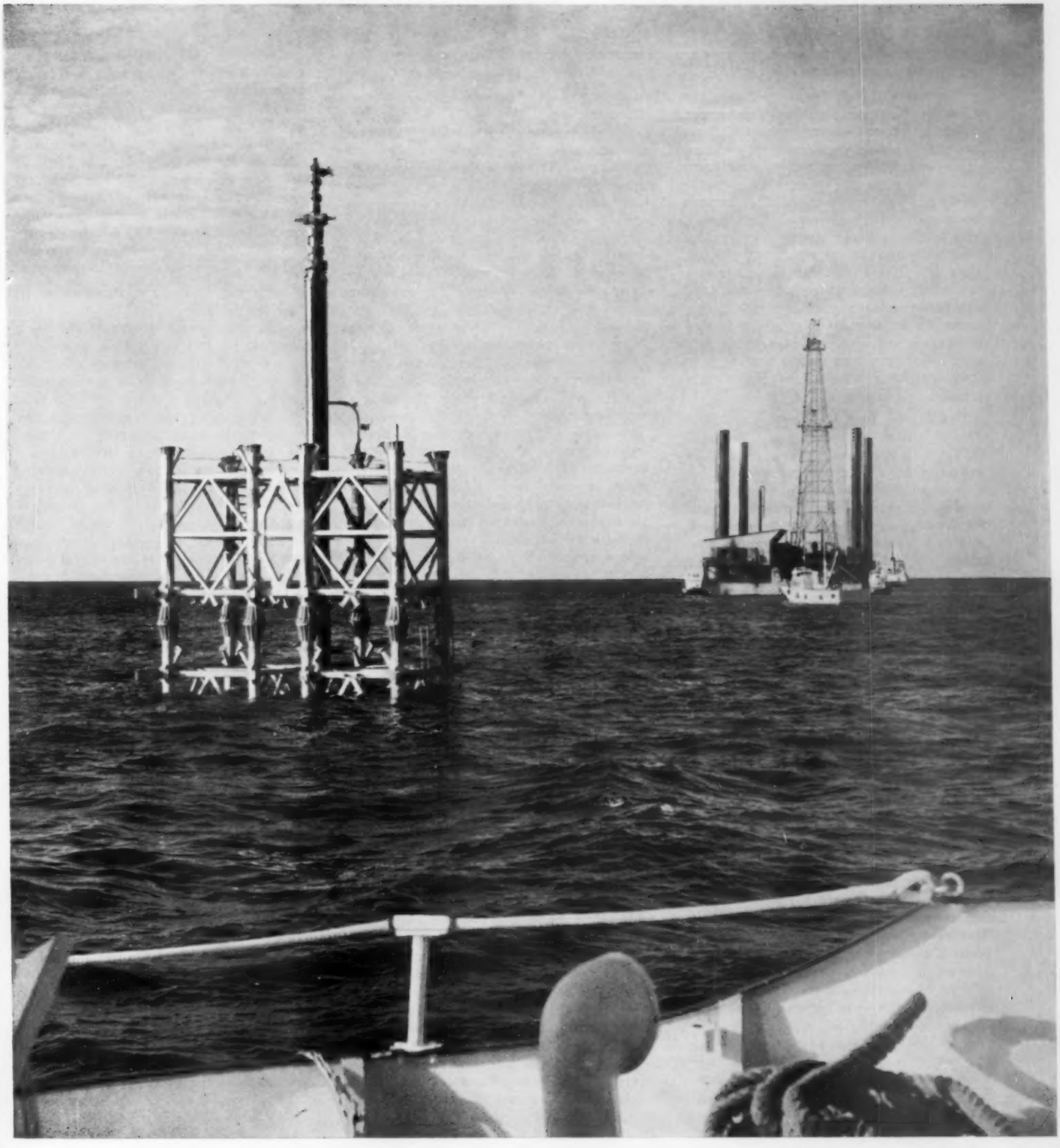
Possible Economies in Intelligent Choice of Method of Well Operation. Selection of the method of lifting oil and gas from wells presents several possibilities. Free natural flow is always less costly than other methods which involve use of mechanically developed power, but use of reservoir energy for lifting purposes is regarded as disadvantageous by some authorities from a long-range cost standpoint. They reason that reservoir energy should be conserved for its most valuable function: that of moving oil from the reservoir into the wells, while mechanically developed power should be used for lifting it to the surface. During early life of many fields when oil reservoirs produce a sufficient volume of high-pressure gas with the oil, continuous gas lift is often the least expensive method of lifting the oil to the surface. As the formation pressure diminishes, continuous gas lift may be continued for a time by use of flow valves, careful design of eduction tubes and control of circulating gas pressures and volumes. When continuous gas lift is no longer feasible, intermittent pneumatic lifting systems are often possible instead of mechanical pumping and may be less costly from a unit production cost standpoint than mechanical pumping.

Eventually, nearly every well must be mechanically pumped and choice of the lifting method widens to include many different types of pumping equipment. The rod-operated oil-well plunger pump generally used for this purpose, can be adapted for efficient operation in lifting oil from depths as great as 12,000 ft and for fluid volumes of several hundred barrels per day. Careful consideration of all of the factors that influence performance of this type of pump will result in selection of an appropriate size of pump and size of tubing and sucker rods, rate and length of stroke that will permit the pump to operate at maximum efficiency. The operating fluid level that can be maintained in the well, the depth of immersion of the standing valve of the pump in the well fluid, and the extent to which gas accompanying the oil may be confined within the annular space between the well tubing and casing, will also have an important influence on pump efficiency.

The kind of power to be employed and the method of applying it to the pumping mechanism will be important considerations in any study of lifting costs. Often both gas-engine power and electric power will be available and the operator must determine which will be most advantageous. Selection of a type of pumping unit that will permit ready adjustment of speed and length of stroke and provide means for achieving balance of the forces operative in the up and down strokes of the rods, will be advantageous. For small rates of production, unit production costs may often be reduced by substituting a multiple well operation system for the individually powered pumping units at each well. For some situations, rodless multiple pumping has definite advantages.

Intermittent Operation of Pumping Wells. Marginal wells or "strippers" may often continue to yield profitable production by operating them intermittently when continuous operation would no longer be possible. In some of the older fields of the Appalachian region, individual wells may be operated only a few hours per week, during which time oil accumulated in or around the well within the reservoir rock is "pumped off." A multiple pumping system may be provided to operate the wells in groups, so that one group may be pumping while others are idle, thus minimizing power costs. If proration rules restrict the production of wells so that the property has a surplus producing capacity, no effort need be made to keep all wells in immediate operating condition as soon as need for repairs develops. The number of repair crews may thus be reduced, wells being shut-in as "idle producers" until such time as a single repair crew can conveniently give them attention. Of course, where wells are not restricted by proration and competitive conditions prevail, every effort will be made to maintain maximum production by keeping all wells in continuous operation with as little "down time" as possible.

Reducing Costs by Timely Abandonment of Unprofitable Wells. Production costs may be reduced by abandoning individual wells as soon as they become unprofitable. In many cases, operators are content to assemble cost records for an entire lease without making any effort to determine individual well productions or costs. The entire group of wells may be profitable but perhaps some individual wells yield such small productions that they are actually unprofitable and over-all profits might be increased if they were abandoned. A system of production and cost records that will permit of determining the unit cost of producing oil at each well provides a basis for abandoning individual wells as soon as they become unprofitable. As long as a well returns its routine operating costs it should be kept on production. That it, overhead, depletion and general costs need not be included in determining when the cost of operating the well exceeds the value of its products. If the selling price of oil and gas is likely to increase, wells may be maintained as "idle producers" available for



ABU DHABI

A well head on the Persian Gulf. In the background, the barge "Adma Enterprise" which is currently drilling beneath the waters of the Gulf. The results are sufficiently encouraging to warrant the preparation of facilities for regular production. This stage should be reached by mid-1962.

BP

future operation if at some future time profits are again possible.

Reduction of Unit Petroleum Production Cost by Reservoir Pressure Maintenance. When an oil and gas reservoir yields large quantities of high-pressure natural gas, there is opportunity for producing oil at lower cost by adopting the pressure maintenance method of field exploitation. This involves compressing the gas trapped from the oil and forcing it back through suitably situated wells into the reservoir from which it came. By this means, more oil is ultimately produced, in a shorter period of time, and at a higher average rate of production, thus increasing the present-day discounted value of the oil and reducing unit production cost. The advantages gained usually more than offset the additional cost of gas compression and injection.

Determining and Maintaining the Most Profitable Rate of Production. In many fields, the rate of production of oil-producing properties is fixed by the state proration authorities. However, this may not be the rate at which maximum profit will result for the producers. Theoretically, each well and each property has its maximum economic rate ("MER") of production which may be greater or less than that fixed by the proration authorities. The producer should estimate his MER, even though he may not be able to achieve it, so that he can restrict his production below that permitted if this seems advisable, or be in a position to request a higher allowance from the proration authorities in the event that the wells are restricted below economic levels.

Usually the MER is regarded as that rate of production which makes most efficient use of reservoir energy, but this is not necessarily the rate which will yield maximum profit. For example, when gas energy is the primary expulsive force operative in the reservoir, the rate of oil production obtained with the lowest gas-oil ratio may yield less ultimate profit than oil production obtained with a higher gas-oil ratio. The production rate yielding maximum profit is the critical MER, which should govern. This involves consideration not only of the ultimate oil recovery obtained, but also the rate of recovery, the economic life, cost of production, selling price and present-day discounted value of the oil and gas to be produced. Aside from the MER of an oil- and gas-producing property, which is fixed by reservoir conditions, economic considerations will dictate the rate of production that will be most profitable to the producer.

Usually an oil-producing company will control the production from several or perhaps many properties. In time of low oil prices or inadequate market demands, the necessary production will be taken from the less costly sources, while high-cost production will be shut in or curtailed. In times of market depression, large producers may find it advantageous to shut-in their own properties and purchase oil to meet their needs from small producers who perhaps, must continue production, even at a loss, to meet their financial obligations.

Economy in Production of Petroleum Through Unitization of Oil and Gas Producing Properties. Large oil and gas producing enterprises generally permit better organization and operation with lower overhead and management expense than small producers. We may therefore hope to reduce production cost by consolidation of a group of small tracts under a single management rather than operate them as separate units. Aside from direct reduction in production costs, we may also anticipate more efficient recovery of oil and gas through opportunity to apply more efficient development programs and better control of reservoir pressures. Wasteful competitive practices may also be avoided by unitization of producing properties. Production may be curtailed in times of over-supply and depressed prices, so that a better average price is obtained for the marketed products. Best results are possible when an entire reservoir may be placed under a single management and operated as a unit. Unitization of properties into large tracts is particularly important in secondary recovery operations.

Cost Reduction by Application of the Principles of Automation to Oil- and Gas-Producing Operations. During the past decade, an industrial revolution has been under way, designed to mechanize operations by substituting automatic for manual controls. The oil- and gas-producing industries have pioneered in developing instruments and control devices that have made it possible to accomplish many field operations automatically which, until comparatively recently, have required manual supervision. Automation has been made necessary by the ever increasing labor costs and as a means of stabilizing production costs in a period of continuing price inflation. Automatic control of production facilities may also promote efficiency in operation of equipment, reduce capital investment, maintenance expense, plant depreciation charges and power cost, and reduce losses of oil and gas. It is particularly advantageous in difficultly accessible or widely scattered well locations, as in offshore operations, in secondary recovery projects or on large tracts where many wells must be operated.

Automatic devices are used to advantage in control of flow of oil and gas from free-flowing, gas-lifting and pumping wells; in intermittent well operation systems; in gauging, sampling and testing well production; and in switching flow of oil and gas through surface facilities. A successful system for automatic custody transfer of oil from lease shipping tanks to pipe-line outlets has also been devised. Control facilities may be assembled at a conveniently situated field office, perhaps remote from some of the well locations, so that it is seldom necessary to visit the individual wells, tanks or gauging facilities. Thus the labor necessary in manual control of field operations can be greatly reduced.

Automatic Control of Free-flowing and Gas-lift Wells. For many years, devices have been available for automatically regulating the rate of production of free-flowing and gas-lift wells. Types of flow-line valves are used that are actuated by electric motors, controlled by electromagnetic or hydraulic devices responsive to changes in well pressure. Intermittent flow of wells may be regulated by a clock or timing device which automatically opens the flow valve of each of a group of wells in sequence for production through a predetermined time interval.

Automatic Control of Pumping Wells. Pumping wells are usually equipped with an individual pumping unit at each well, operated by either an electric motor or a gas engine. Formerly "pumpers" were employed—perhaps one man for every 20 wells—to move about through the field, visiting each well in turn, to be certain that the power plant and pumping mechanism are operating properly and to make necessary adjustments. Modern well-pumping equipment is now so well designed and constructed that it seldom fails in service, so that one pumper can take charge of a much larger number of wells. Simple control devices located at a convenient central point, provide a means of shutting down or starting the power plant at any individual well and an alarm system may indicate stoppage or "racing" of a gas engine or motor, occasioned perhaps by breakage of sucker rods, belts or gears; "pumping-off" of fluid in wells, or failure of the power supply.

Automatically Controlled Tank Batteries. A flow line from a well or gas trap, delivering oil into either of a pair of flow tanks, may be equipped with a three-way valve responsive to an electrical signal from a fluid-level indicating device in each of the tanks. When one of the two tanks is filled to a certain fluid level, the incoming flow of oil is automatically switched to the other. Simultaneously, another automatically-controlled valve in the discharge line of the full tank is opened, so that the oil may be pumped to a field storage tank or a dehydrating plant while the second tank is filling. When the fluid level in the draining tank falls to a certain level, the discharge line valve closes and the first tank is ready to receive oil when the second tank is filled. A counting device maintains a record of the number of times flow is switched from one tank to the other, and if the capacity of the tanks between high and low level is known, an approximate record of the volume of production passing through the tanks may be calculated. Oil passing through the gathering line from each pair of tanks may also be measured by an oil meter which automatically records the volume of oil produced by the well or wells served. Water and sediment settling from the oil in the flow tanks accumulates in a bottom layer of fluid in each tank and must be occasionally drained and, if desired, its volume measured and recorded.

Devices are also available for gathering a representative sample of the oil produced by each well and automatically determin-

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ing and recording its temperature, water and sediment content, and gravity. A "telemetering" device may electrically transmit the data gathered by these automatic tank-switching, metering, sampling and testing devices and record the information in a remote field office. It may also be arranged that any malfunction of the equipment will automatically close a valve in the flow line from the well and operate an alarm bell or light in the field office.

We need not provide an automatic tank battery for each well. Instead, it may be arranged that one tank battery shall serve a group of wells and facilities are provided for diverting flow from any one of the wells of the group into the tank battery for a period of gauging, sampling and testing, while other wells of the group deliver their production through oil meters into field gathering lines or lease storage tanks.

Lease Automatic Custody Transfer. It has been customary in the oil-producing industry to maintain an accurate record of the volume and quality of the oil and gas produced on each separate property. Where land is leased, a certain percentage of the value of the oil and gas produced must be paid to the land owner as royalty. Often custody of the oil and gas produced is transferred by the producer at a shipping tank on the property connected with the purchaser's pipelines. Payment for the oil and gas to the producer and royalty owner is based on an accurate gauging, sampling and testing of the oil at the shipping point or in nearby field laboratories. Until recently, these operations have been conducted by manual methods, by two "gaugers," one representing the producer and the other the purchaser. When all the data have been assembled, a "run ticket" is prepared certifying to the quantity and quality of the oil and gas shipped from the property.

Recently, equipment has been devised for doing automatically all of the necessary operations in custody transfer. In a typical LACT installation, oil from the lease shipping tank is released by an automatic valve and flows through a pair of small spherical tanks, in one of which it is chemically treated prior to centrifuging. Water and sediment are separated from the treated oil by centrifuging. Dehydrated, clean oil in the second tank is passed through a dielectric cell which records its dielectric constant as a measure of its water "cut," and through an oil meter which records its volume. Samples diverted from the oil stream are automatically treated to determine the temperature and gravity of the oil passing through the meter. An automatic computer applies the measured water "cut" and temperature to the volume of oil recorded by the meter to calculate the net volume of clean oil. When the fluid level in the shipping tank falls to a certain level, the outlet valve automatically closes. When oil again accumulates to a certain high level in the shipping tank, the outlet valve again opens and the whole sequence of operations is repeated.

All of these operations may be performed without the immediate supervision or control of an attendant and records are preserved which may be dispatched by a telemetering device to a remote office where master controls are situated, and automatically recorded in tabulated form. Alarm signals at the control point indicate any malfunction of the equipment. LACT is rapidly becoming a recognized means of gauging lease production as a basis for adjustment of obligations between oil buyers, sellers and royalty owners.

Gas gauging is much simpler. It has been customary for many years to use recording orifice meters for this purpose. They may be installed on pipelines to record the volume and pressure of gas passing into the purchaser's pipelines, or at intermediate points on gathering lines to record the volume and pressure of gas produced from individual wells. A telemetering device may record the pressure temperature and rate of flow in a remote field office or chart records may be gathered daily and removed to the field office for the necessary calculations. If the gas is "wet" gas on its way to a natural gasoline recovery plant, it may also be necessary to install instrumentation for automatically determining its density or its percentage content of condensable fractions.

Cost Reduction Through Use of Electronic Computers and Data Processing Machines. The modern oil company office is equipped with automatic computers and data-processing machines that greatly assist the clerical and technical staffs in the accounting and cost-keeping routines, in preparing production records, pay rolls, inventories and other essential records. These machines provide a means of conducting the paper work of the office with less labor and greater accuracy. The equipment also finds use in other departments of the oil-company organization, particularly in the engineering and research departments.

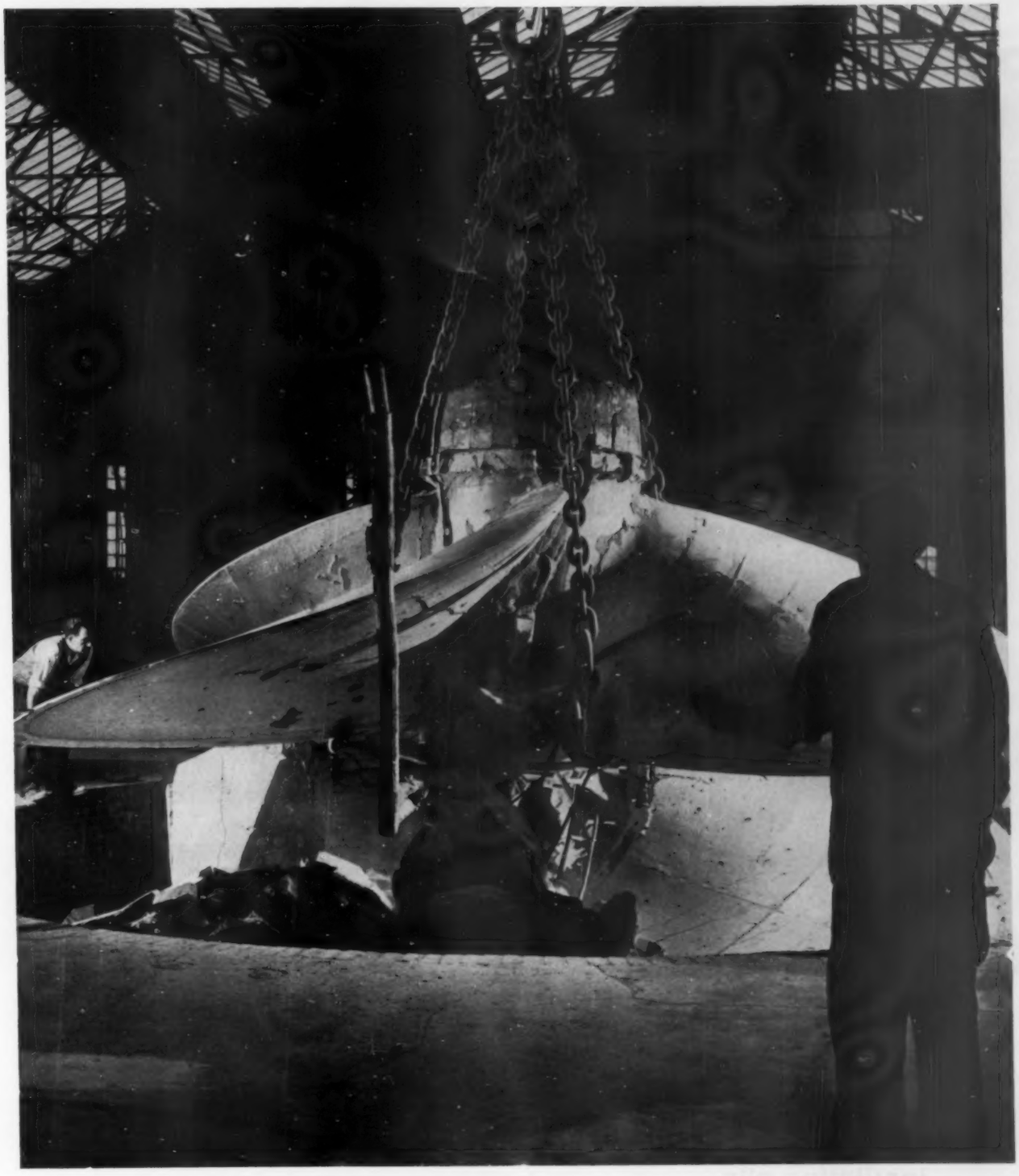
Automatic computers are complex devices, usually operated electronically, and are adaptable to a wide variety of problems. They may be broadly classified into two groups: (1) digital computers, and (2) analog computers. Digital computers really do nothing more than simple mathematical operations involving addition, subtraction, multiplication and division, but almost any mathematical problem can be broken down into a series of these operations and the machine performs them with such speed and assured accuracy that they relieve the office staff of much time spent in routine repetitive calculations. Analog computers do not utilize mathematical routines. Instead, they solve problems by measuring electrical or other forces in a system of conductors that behave in a manner analogous or comparable with forces active in the problem to be solved. They are particularly useful in solving production problems involving prediction of rates of production and decline of reservoir pressures within different time periods.

A variety of different sizes and types of electronic computers are available from different manufacturers. Operators must be specially trained to use these machines and training in engineering and advanced mathematics is advisable. The more elaborate computers must be carefully "programmed," or adjusted to follow the sequence of operations involved in the particular problem to be solved. Almost every department of the oil company establishment may be served by computers, and because of their high cost and the specialized training necessary for operators, some of the larger oil companies find it expedient to establish computer centers where the equipment and operating personnel are assembled. A computer center may work on exploration, development, production, processing, marketing and research problems; it may turn out pay rolls, inventories, sales statistics, employees savings records, dividend checks and other accounting, cost-keeping and financial records involving millions of calculations each month.

Electronic data-processing machines have also found wide application in oil company operations. For use in these machines, the basic data are recorded on punch cards, paper or magnetic tape or on magnetic drums capable of storing many thousands of figures and formulae necessary in computations. The punch cards provide as many as 90 columns in which slot-shaped holes may be punched to record as many different items in patterns that represent their numerical values. Running these cards rapidly through a sorting machine will enable the machine to classify, file, find and summarize the information recorded on each card, handling as many as 100,000 items in a 6-hour day. Some data-processing machines are designed to use punched paper tape or magnetic tape instead of punched cards. Used in connection with the data processing machines are tabulating and printing machines which sense the data on the record cards or tape as they pass rapidly through the sorting process and produce printed records in tabular form, itemizing the data and adding column totals. Computers and data-processing machines are conveniently used together as parts of a data-automation system.

• • •

The methods of minimizing production costs discussed in the foregoing sections involve procedures familiar to all petroleum engineers. It follows that an experienced petroleum engineer is the type of person best qualified to study an operating organization with the purpose of effecting changes that will result in reduced production costs. Many seemingly successful and prosperous oil companies could profit by studies of this character. Many unsuccessful operators could turn losses into profits by a careful engineering study of their operating practices. The items suggested in this brief review are but a few of the many cost-saving devices that could profitably be studied in a complete cost analysis. END



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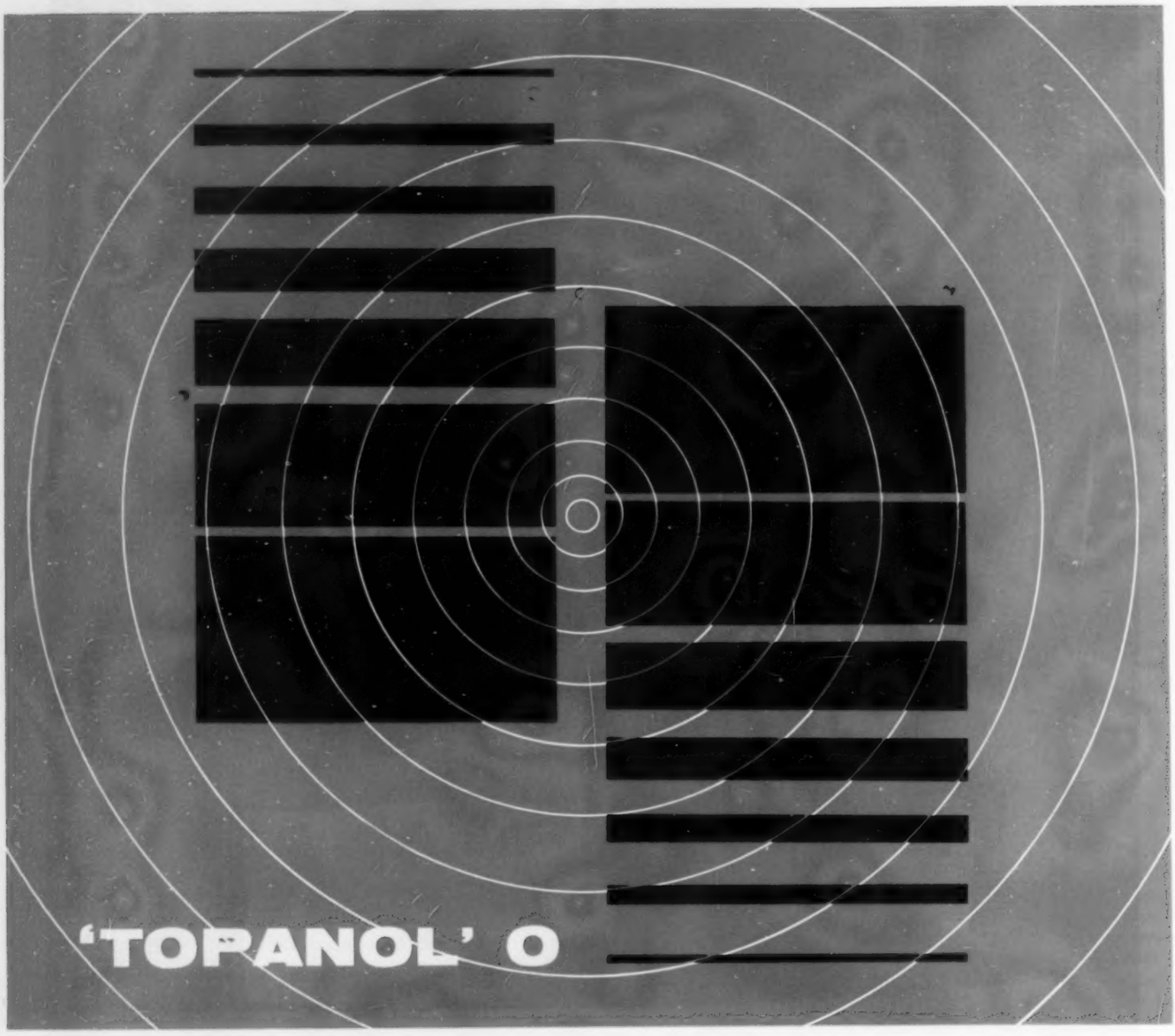

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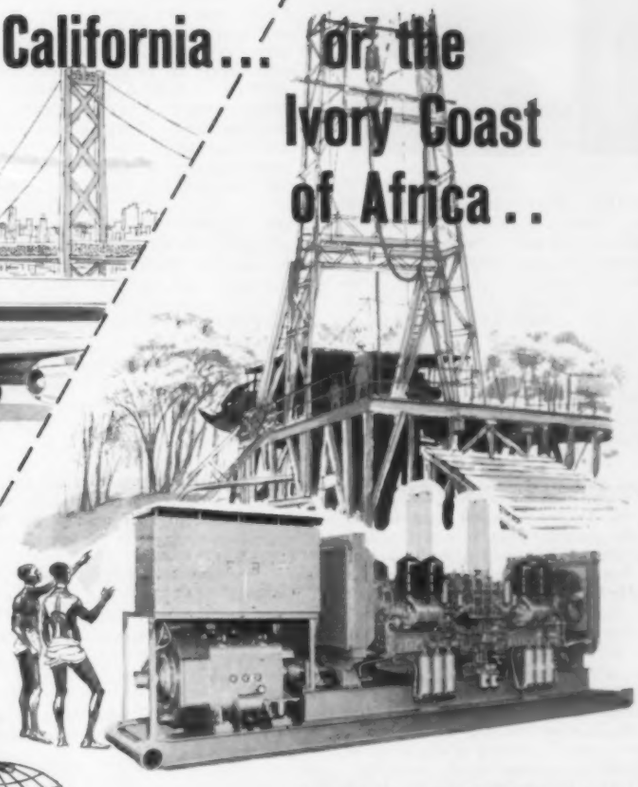

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ERNEST MONCRIEF, from vice president, Mid Continent Division, Fluor Corp., Houston, Texas, has moved to the newly-created post of vice president—coordinator of foreign operations and affiliates, and **JAMES P. WISEMAN,** from president, Fluor Products Co., to Moncrief's former position. Mr. Moncrief will coordinate the activities of parent company subsidiaries and affiliates, including The Fluor Corp. of Canada, Ltd.; Fluor Engineering & Construction Co., Ltd. of London, England; Fluor-Schuytvlot, N.V. of Haarlem, Holland; Singmaster & Breyer, Inc.; and H. G. Acres and Company, Ltd. He will operate from Fluor's headquarters in Los Angeles.

E. W. DISSLER of Calgary, has been appointed manager of exploration for Cities Service Oil Co. (Del.) to succeed Reese H. Tucker who has been elected vice president of the parent Cities Service Co. Mr. Dissler has been serving as vice president and manager of Canada-Cities Service Petroleum Corp. for the past three years. He is also vice president of Cities Service Athabasca, Inc. **C. E. COLE** of Shreveport, La., who started his career with Cities Service in 1941, is the new exploration manager of Canada-Cities Service company at Calgary.

P. L. VANLUE, financial assistant to the vice president of Domestic Production, has been elected treasurer, controller and assistant secretary of Oasis Oil of Libya. **E. A. GRAHAM,** assistant to the treasurer, and **L. F. WILLHITE,** division controller for Ohio Oil's Casper (Wyo.) production division have been elected assistant treasurers and assistant controllers of the subsidiary. **L. J. QUALKENBUSH,** presently controller and assistant secretary of Oasis, and R. R. Arneson, assistant controller, are being reassigned to the Ohio Oil Co.

C. D. READ has been appointed manager of the manufacturing department, of Gulf Eastern Co., a Gulf subsidiary in Europe. He will supervise all manufacturing and product supply matters relating to Gulf's operations in western Europe, the United Kingdom, and other assigned areas in the Eastern Hemisphere. He will have offices at the headquarters of Gulf Eastern Co. in London.

D. C. WIXSON has been named administrative vice president for the Sunray family of companies.

W. C. STOUT, has been promoted to the newly created position of coordinator of reserves and production acquisitions for Continental Oil Co. Formerly manager of the headquarters land section, he will continue to make his headquarters in Houston and will assist in the acquisition of reserves and producing properties.

AMOS K. SMITH is the new coordinator of marketing, supply, and distribution in the general office of Standard Oil Co. (Indiana). **THOMAS L. BRANSFORD** will succeed Mr. Smith as manager of the sales promotion and sales training department.

JOHN M. SHEA, Jr. and **RALPH E. DAMP,** have been elected to the board, and as corporate vice presidents, of American Petrofina, Inc.

I. C. ANDERSON, manager of the export sales department of Creole Petroleum Corp., has been elected a vice president of the company. Mr. Anderson has had 23 years of service with affiliates of Standard Oil Co. (New Jersey), spending the last 13 years as a staff member, assistant manager and manager of Creole's export sales department in the New York office of the company.

BERT I. GRAVES, well known petroleum executive, has been elected a director of Regan Industries, Inc., electronics and graphic arts equipment manufacturers, with administrative headquarters in Burlingame, Calif., near San Francisco. Mr. Graves is president and founder of B. I. Graves Associates, San Francisco, petroleum consultants. In addition, he is a director of the Natomas Corp., San Francisco, and the Peerless Insurance Co., Keene, N. H. and other corporations. Prior to organizing his own firm in 1953, Mr. Graves was vice president and director of Tidewater Associated Oil Co. and chairman of the company's Eastern Division Operating Committee with full charge of East Coast operations.

DR. ENRICO MATTEI has been elected managing director of AGIP, oil company owned by the Italian government. Prof. Marcello Boldrini was elected chairman, and Dr. Eugenio Cefis vice chairman.

DAVID H. FINNIE has been named to replace **WILLIAM TATGE** as alternate director in London for Mobil International Oil Co.'s interests in Iran. Replacing Finnie in New York as joint venture coordinator for Mobil's interests in Iraq is **RONALD F. DICK.** Mr. Tatge becomes director of relations for Mobil in Libya.

G. B. RYAN has moved from the Gulf Coast Division, production department, Standard Oil Co. (Ohio) in Houston, to staff assistant to **W. K. BERGEN,** operations manager in the manufacturing department, Cleveland.

DEWEY MARK, named manager of petrochemical sales for Tennessee Oil Refining Co., a division of Tennessee Gas Transmission Co., from general sales manager, chemical division, Vickers Petroleum Co., Inc., Wichita, Kansas.

CALVIN SPIVEY, with Petty Geophysical Co., San Antonio, Texas, has been transferred to Australia as area manager.

EDWARD M. CONNAUGHTON, senior economist, Socony Mobil Oil Co. is in Tehran on a special assignment with the National Iranian Oil Co. He will help to reorganize the Iranian company's economics department. He will return to New York in September.

W. H. KUCK has been appointed supervisor of the Ohio Oil Co.'s income tax department. He succeeds E. R. Krouse, who recently was named financial assistant to the vice president of domestic production.

E. H. HERMSEN, of Los Angeles, was elected corporate secretary of Tidewater Oil Co., succeeding W. J. Burker, who has retired after 40 years of service. Mr. Hermsen has been assistant secretary.

JOSEPH F. GOETTEN has been appointed manager of the tax department of Standard Oil Co. (Indiana), with responsibilities for tax matters concerning the consolidated company. Mr. Goetten succeeds **ELDON O. HANSON,** who retired after 19 years of company service.

E. SINGER, to development supervisor at Shell Development Co.'s Emeryville Research Center, concerned with the application of machine programming methods to process design and evaluation in the oil process engineering department.

JOHN A. COVER, to technical manager, Port Neches, Texas, plant of Goodrich-Gulf Chemicals, Inc.

HARVEY E. PHELPS to manager-mechanical design and construction, Goodrich-Gulf Chemicals, Inc., with responsibility for the design and construction of new manufacturing facilities for the corporation.

J. PAUL JONES of Bradford was relected president and executive manager of the Pennsylvania Grade Crude Oil Association at a meeting of the board of directors following the recent 37th annual meeting of the organization held at the Pennhills Club, Bradford.

Karney R. Cochran, Bradley Producing Corp., Wellsville, N. Y., who had previously served as second vice president, was elected first vice president to succeed G. J. Hanks, resigned, and A. C. Simmons of Bradford was elected second vice president.

ALBERT L. THOMPSON, engineer in the pipeline department of the Lion Oil Division of Monsanto Chemical Co. has been promoted to crude oil purchasing and pipeline superintendent. He will replace Rodney R. Landes resigned.

P. W. JUDAH has been named manager of two major divisions within Mobil Chemical Co., the newly formed chemical enterprise of Socony Mobil Oil Co., Inc. Mr. Judah, who has served as manager of Socony Mobil's petroleum chemicals department since November 1956, will head the basic petroleum chemicals division and the paint and special products division.

P. W. Judah

E. N. Leibacher

EDWARD N. LEIBACHER, a veteran of 44 years in the international oil industry with service in technical and managerial posts in the United States, Europe and Asia, retired July 1 as a vice president and director of Standard-Vacuum Oil Co. He had been a vice president as well since May, 1955.

ALESSANDRO ZATTI, who has been a director of Esso Italiana for many years, will become a vice president of that company later this summer. **C. J. HEDLUND,** who will resign as manager of the coordination and petroleum economics department of Standard Oil Co. (N. J.), will become a director and vice president of Esso Italiana and take up residence in Genoa. **R. T. BONN,** who presently is with Esso Export Corp., will become a director of Esso Italiana to succeed **E. G. BROMING,** who will be transferred to Jersey Standard. **L. PITTALUGA,** assistant comptroller of Esso Italiana, will be appointed comptroller of that company to succeed D. J. Thompson, who will resign from Esso Italiana to become a director of Esso Switzerland.

W. S. SCHELLENTRAGER, from process coordinator, engineering division, Standard Oil Co. (Ohio) manufacturing department, to temporary assignment as project manager for the Joplin, Mo. expansion of Solar Nitrogen Chemicals, Inc.

NORMAN C. MILLER, chief geologist of Delhi-Taylor Oil Corp., has been appointed to the newly created position of manager of exploration. He will supervise all foreign and domestic exploration activities. He will be succeeded as chief geologist by J. D. Nunnally, formerly exploration coordinator-Gulf Coast for Gulf Oil Corp.

CHARLES E. WEBBER has been appointed director of natural gas administration for Sun Oil Co. heading a newly-organized group responsible for supervision of natural gas sales and the accompanying Federal Power Commission certificate applications, gas rate filings, rate investigations and related matters. H. Douglas Coe will be his assistant. Mr. Webber formerly was technical adviser to the vice president in charge of production. He joined Sun in 1945 following service as assistant director of the natural gas and natural gasoline division of Petroleum Administration for War.

HERBERT J. WEEKS

Herbert J. Weeks, 62, a geological counselor to Sun Oil Co.'s foreign operations department and vice president of nine subsidiary companies engaged in foreign exploration and production died recently. A 37-year Sun veteran, Mr. Weeks' geological work carried him through most of the United States, much of Canada, and to Mexico, Venezuela, Colombia and several Central American countries.

G. M. Forgan

M. E. Ziegenhagen

H. C. TEASDEL has been elected a vice president and director and **GLENN M. FORGAN** a director of General Gas Corp., a leading southern distributor of liquefied petroleum gas. Mr. Teasdel previously served as president and chairman of the board of The California Co. Mr. Forgan is vice president of The First National Bank of Chicago, and serves as head of the Bank's Division which handles all phases of the institution's oil and gas financing activities.

JOHN RICCA, formerly general purchasing agent for Arabian American Oil Co. and Aramco Overseas Co., has been appointed manager of purchasing and traffic for the Oasis Oil Co. of Libya, Inc. Oasis Oil recently was incorporated to conduct exploration, development and transportation operations in Libya for the Ohio Oil Co., Amerada Petroleum Co. and Continental Oil Co.

CLARENCE B. ROUND, from assistant superintendent, Ponca City, Okla., refinery, to manager of manufacturing for Continental Oil Co.'s Rocky Mountain region, with headquarters in Denver, succeeding **W. F. BROWN,** recently transferred to the executive offices at Houston, Texas, as special assistant to the senior vice president.

Texaco Affiliate Name Change

Experiment Inc., a wholly-owned subsidiary of Texaco Inc. and one of the nation's leading high-energy fuels research organizations, changed its name to "Texaco Experiment Inc.," on July 1, 1960. "TEI," or Texaco Experiment Inc., was founded in 1945 by its present President, Dr. James W. Mullen II, and has specialized ever since in fundamental research on combustion processes and on the development of propulsion systems for missiles and space vehicles. TEI is located in Richmond, Virginia.

Babcock & Wilcox Appointment

M. E. Ziegenhagen has been appointed director of advertising and public relations of The Babcock & Wilcox Co., it was announced recently by M. Nielsen, president. Mr. Ziegenhagen's experience in advertising and public relations includes 12 years of service with the General Electric Co. and 8 years as manager of these activities with the Worthington Corp. Making his headquarters in the Babcock & Wilcox general offices in New York City, he will report to the vice president in charge of the Staff division. He will be responsible at the corporate level for the direction and centralized coordination of advertising and publicity, and will serve all company divisions and subsidiaries in these functions.

New Vacuum Building In Australia

The Vacuum Oil Co. has completed a new 15-story headquarters building in Melbourne at a cost of nearly $4 million. Features of the fully air conditioned building include basement parking for more than 50 cars, a hairdressers salon for employees, indoor gardens, hospital, dining room and theatrette, music in all offices, and a metal mural in the foyer by Sydney artist Douglas Annand telling the story of oil.

Crude Stability Coming

Petroleum overproduction, under way for some time, is now undergoing "corrective processes," according to Leo D. Welch, board chairman for Standard of New Jersey; but he said it "might be a year or two, or it could be longer" before a normal balance is restored. Jersey's president Rathbone still expects a gain of 4% to 5% over 1959 in 1960 oil use in the USA, and a rise of 6% to 7% in the world outside the USA.

J. G. Clark

J. T. Rodgers

Hunt Tool Appointments

Thomas N. Hunt, president of the Hunt Tool Co., announces the appointment of Jack G. Clark as superintendent of the Houston plant and Jack T. Rodgers as assistant secretary-treasurer.

Texaco Research Center

Texaco Inc. will construct a large research center in Port Arthur, Texas, where its largest domestic refinery is located. To be the company's second major research center, the project will cost an estimated $7.5 million and require five years to complete.

Offshore Drilling Cut

Louisiana has temporarily restricted multiple oil-well completions (the tapping of more than one producing zone by a single well). The order has stirred speculation that offshore drilling activity, on the rise recently, may be curtailed. Louisiana's conservation commissioner Mouton said the order is designed to curtail Louisiana production until markets are available for the crude.

Schmieder Heads API Committee

F. R. Schmieder, general superintendent for Shell Oil Co. covering their Pacific Coast Area operations, has been appointed chairman of the API National Committee on Supervisory Development. He succeeded Vernon Blacklock.

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by William C. Uhl
Processing Editor

Highlights of the month—latest USA automobile output figures continue to indicate small cars will hurt motor fuel sales volumes; trends in refining in Latin America; construction costs in Latin America reviewed.

Now that the USA automobile output data are firm for the first half of 1960, another look at the probable impact of the compact "economy" cars on the USA gasoline market confirms earlier expectations. Small cars are going to hurt sales.

Much has been printed or delivered from speakers' platforms on this subject since WORLD PETROLEUM reported the outlook last fall ("The Changing Auto Pattern—and Its Meaning to U. S. Refiners," November, 1959, pp. 72-78). At that time, a rather disheartening forecast indicated that average gasoline consumption per car in the USA could drop as much as 10.8% by 1964. A somewhat more accurate approach to this calculation now shows that the drop is still expected to be sizeable—about 7.3%.

This prediction, developed as shown in the accompanying table, is based on an expected increase of small cars to 21% of the total cars on the road by 1964, and on the other assumptions shown in the table. The ratio of 21% is based upon a trend which anticipated new small cars registered this year to be 23.1%.

Since last fall, perhaps the single most significant development is that 1960 small car registrations have taken—not 23.1% but rather—25.8% of the total US industry output. In fact, as of July 5th, the millionth USA-built compact car was produced. Add to this the strong probability that non-USA small cars entering the American market will hit some 500,000 units, and it is not at all difficult to predict a ratio of some 30% for small cars to total cars produced this year.

Assuming then that this trend curve will become more steep for the coming four or five years, the outlook for small cars to total cars on the road in 1964 is about 25%. Applying these revisions, as shown also in the table, and the drop in potential gasoline consumption would be 8.9%.

These figures, both the original and the revisions, have all been developed by Harry L. Moir, vice president and general manager, retail marketing, Pure Oil Co., and chairman of the American Petroleum Institute's Committee on Stimulating Gasoline Demand. Mr. Moir quite properly points out that no matter how precise the predictions might be, "these smaller cars are going to make an impact on the trend of gasoline sales. Not only must the refiners, but the marketers as well, take this into consideration when preparing forecasts in any year."

Another strong indication of the impact of the economy cars has been in the effect on gasoline tax receipts. New York State—where car registrations represent about 7% of the USA total—has noticed that its tax receipts are climbing at a much lower rate than in the past. In the year ending March 31, 1960, New York's state gasoline tax receipts rose $3 million as compared with a rise of $4.87 million the previous year.

As a confirmation that there are indeed more small cars in New York, the state's revenue from automobile licenses (rates are based on weight of car) has also shown a slower rate of increase. The average license fee rose only 14c per car in 1959 versus 21c in 1958, and the estimated increase this year is 10c. The state has now undertaken a detailed study of the effects of small cars on revenue.

That the public has given good acceptance to the compacts is reflected in the sales as well as in the fact that the American auto makers will introduce still more light-weight and lower priced 1961 models of the other names—Buick, Olds, Pontiac, etc.—during the next few months. Detroit will of course be the first to admit it has made errors of judgment in the past and might very well do so again.

The predicted loss in fuel consumption has more recently been echoed by a General Motors engineer, Max M. Roensch of the Chevrolet Division, in a talk at the annual meeting of the Western Petroleum Refiners' Association in San Antonio. Mr. Roensch said that passenger car gasoline consumption in 1970 would reach 76 billion gallons on the basis of present trends in compact cars as compared with 83 billion gallons if all cars remained full size. And his calculations did not include non-USA cars.

However, it is difficult to draw firm conclusions at this time, Mr. Roensch pointed out, saying that any reduction in total fuel consumption caused by the better economy of the compacts could be counterbalanced by a greater overall use of automobiles in the next 10 years.

Of equal, or perhaps even more, interest is the effect of compact cars on fuel characteristics. Surveys made by Chevrolet's engineering department and the Ethyl Corp. indicate that 75% of all 1960 USA passenger cars produced will be designed to use regular grade gasoline, Mr. Roensch stated. This percentage was about 65 last year and less than 50 in 1958. It had been declining from 75% since 1954.

As far as fuel volatility is concerned, it is felt that compact cars in general will be less sensitive to vapor lock than the big cars because of lower fuel demand on acceleration.

The coming decade in Latin American refining will see several major trends, according to S. W. Curry and E. W. Schnabel of Universal Oil Products Co. in a paper given late in June in Mexico City at a joint meeting of the American Institute of Chemical Engineers and the Instituto Mexicanos de Inginieros Quimicos. (Latin America was defined as including all of South America, Central America, the Caribbean area, and Mexico).

1. Refining capacity will rise by 50% by 1969.

2. Daily average domestic demand (excluding export demand) in 1970 will have risen to 4.3 million b/d, compared with the 1959 level of about 1.4 million b/d.

3. Changing product requirements will effect higher yields of distillates and gasolines and a reduction in residual fuels. Gasoline demand will increase 250%, from today's 458,000 b/d to 1.6 million b/d in 1970. Kerosine will rise 312%, from 141,000 to 580,000 b/d; distillates will go up 314%, from 261,000 to 1.08 million b/d; and residual fuels will increase 82.8%, from 531,000 to 970,000 b/d.

4. Motor fuel octane requirements will increase from today's level of about 84.6 Research Octane to approximately 94.3 R.O.N.

In terms of processes, this means Latin American refiners will have to rely more and more on catalytic cracking or hydrocracking techniques, plus catalytic reforming, alkylation, and polymerization.

Working this out on the basis of a "theoretical average refinery," the UOP authors showed the following expected changes. Today, the average Latin American refinery has 38,000 b/d of crude capacity, and uses the following processes (in percentage of

(*Continued on page* 82)

Estimated Effect of Economy Cars on Gasoline Consumption in 1964

These estimates are based on the following assumptions: total cars in 1964, 66.6 million (from NPN Fact Book, 1959); average annual miles per car in 1964, 9,500 (NPN Fact Book, 1959); estimated annual gallons per car: large cars @ 14.7 mpg, 646; small cars @ 25 mpg, 380.

Estimated consumption in 1964 (proportion of economy cars remains 3.6%):

	% of total	No. of cars (millions)	Gallons per car	Total gals. (billions)
Large cars	96.4	64.2	646	41.5
Small cars	3.6	2.4	380	0.9
Total	100.0	66.6	636 (avg)	42.4

Average mpg for all cars, 14.9

Estimated consumption in 1964 (economy cars proportion grows to 21%):

Large cars	79.0	52.6	646	34.0
Small cars	21.0	14.0	380	5.3
Total	100.0	66.6	590 (avg)	39.3

Average mpg for all cars, 16.1

Potential loss in consumption, 3.1 billion gals, or 7.3%.

Estimated consumption in 1964 (economy cars proportion grows to 25%):

Large cars	75.0	49.95	646	32.3
Small cars	25.0	16.65	380	6.3
Total	100.0	66.6	580 (avg)	38.6

Average mpg for all cars, 16.4

Potential loss in consumption, 3.8 billion gals, or 8.9%.

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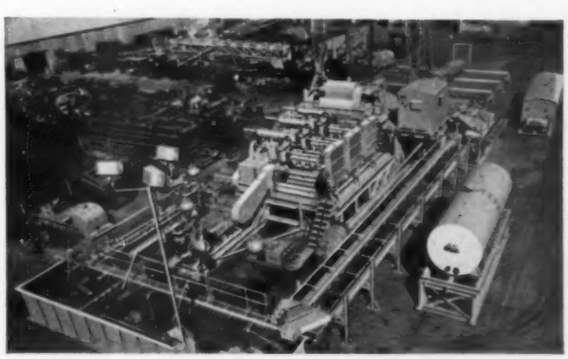

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crude capacity): thermal cracking, 26.3%; catalytic cracking and/or hydrocracking, 12.9%; thermal and catalytic reforming, 2.6%; hydrogen treating, 3.4%; alkylation, 0.8%; and polymerization, 0.6%.

By 1970, this average refinery will be 48,000 b/d, and the processes will be: thermal cracking, none; catalytic cracking and/or hydrocracking, 37.5%; catalytic reforming, 15.6%; hydrogen treating, 17.0%; alkylation, 3.8%; and polymerization, 1.3%.

These forecasts indicate that the average refiner in Latin America will spend some $20 million during the coming ten years on capital additions. This total was developed on the basis of the following capacity increases and installed per-barrel costs, including an average factor for auxiliaries:

Processes	b/d added	$/bbl	Totals
Crude and aux.	10,000	1,000	$10,000,000
Catalytic cracking	13,100	340	4,510,000
Catalytic reforming	6,500	300	1,950,000
Hydrogen treating	6,700	200	1,340,000
Alkylation	1,500	1,200	1,800,000
Polymerization	400	1,000	400,000
Total			$20,000,000

Costs of construction in Latin America are not appreciably different from those in the USA, and they are reasonably predictable, according to Gerard R. Lawrence of The Lummus Co., another speaker at the Mexico City meeting of the AIChE and the IMIQ. He said the installed costs of the Latin American plant do not vary more than 10% from their USA counterparts.

Among the factors which have an influence on costs are accessability of location, climate, construction, labor and tools, origin of materials, financing, reliability of utilities, and size.

Cost of freight is the most obvious direct effect of geographical location, he said. At the southern end of the hemisphere it can add 10% to the cost of materials. Location can also mean isolation from equipment manufacturers, servicing, and technical assistance, as well as skilled and specialized maintenance services. Isolation can also mean that large stocks of spare parts must be maintained.

As for labor costs, although most Latin American countries have considerably lower wage scales than does the USA, this is not always the rule. In Venezuela, for example, Mr. Lawrence pointed out that construction work in the oil industry can actually exceed its USA equivalent, and labor can be 75% of the USA rate.

The near future will probably see plant costs in the more highly industrialized areas of the entire Western Hemisphere converge more and more closely. A large proportion of materials will be obtained regionally, particularly because of common market arrangements. Labor wage rates in Latin America will tend to rise rapidly; however, the effects on construction costs will likely be compensated through increased production.

What's New in Processing Plants

Shell Oil Co. of Canada Ltd. will complete by December a $3 million distillate hydrodesulfurization unit at Montreal, Que. Canadian Bechtel Ltd. has the contract.

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Shell Chile Ltd.'s new 40 ton/day lube oil plant, now on stream at Las Salinas, is expected to save Chile more than $400,000 annually in foreign exchange.

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Imperial Oil Ltd. has started building a 32,000 b/d Hydrofiner, for furnace oil, at Sarnia, Ont.

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Both Shell and Jersey Standard are reportedly formulating plans for a refinery at Acajutla, El Salvador. No information on expected capacity has been revealed.

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Conchon Oil Refinery, Lima, Peru, will go into construction in September at a cost of $15 million. Financing is by the Bank of America and the Banco Popular of Peru.

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Plans for a refinery by Korean Petroleum Co. have received a setback. Following the overthrow of President Syngman Rhee, the present caretaker government has frozen the $5 million previously advanced towards refinery construction.

World's largest ethylene unit, being built at Beaumont, Texas, by Mobil Chemical Co., newest operating division of Socony Mobil Oil Co., Inc., is scheduled for completion early in 1961.

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The Yugoslav state oil company plans a refinery at Zara, on the Dalmatian coast, with an initial capacity of 400,000 ton/yr (8,000 b/d), to be increased by stages to 1.2 million ton/yr (24,000 b/d).

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With the completion of the Rotterdam-Godorf-Wesseling pipeline, the 4 million ton/yr refinery of Deutsche Shell AG at Godorf was expected to be in operation last month.

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Iraq Petroleum Co. Ltd. has awarded Foster Wheeler Ltd. a contract for the design and construction of a 250,000 b/d crude oil sweetening plant at Kirkuk.

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British American Oil Co. will construct a 3,500 b/d naphtha hydrodesulfurizer at Calgary, Alberta. Fluor Corp. of Canada has the contract.

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ENI, the Italian state company, will build a $20 million, 20,000 b/d refinery at La Skirrha, Tunisia, with expected eventual capacity of 30,000 b/d.

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A group composed of Cities Service, Richfield, and CAMPSA, Spanish government oil marketing concern, plans a bid to build a refinery at Bilbao, Spain.

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Cuban Petroleum Institute has indicated plans to build a 20,000 b/d refinery in the Havana or in the Cienfuegos area of Cuba. The plant would process oil from the USSR under an oil-sugar trade agreement.

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Maruzen Oil Co. and Toyo Menka Kaisha Ltd. (a Mitsui company operating in Singapore) will build a $7 million, 20,000 b/d refinery at Singapore, with completion planned for November, 1961.

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Miranco Co., a newly formed independent firm, is erecting a 500 b/d lube oil plant at Mendrisio, Switzerland. Completion of the $1.5 million facility is expected by end-1960.

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Standard Oil Co. (Indiana) is building a 12,000 b/d sulfuric acid alkylation unit at Whiting, Ind., with completion scheduled for early in 1961.

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What's New in Petrochemicals

Duranor, Industrial Quimicas S.A. Industrial y Commercial, plans a multi-million dollar, 25 metric ton/day phenol plant at Rio Tercero, Cordoba province, Argentina, about 450 miles northwest of Buenos Aires. Completion is expected in about two years. Duranor was formed recently by Atanor, Cia. Nacional para la Industria Quimica and Hooker Chemical Corp.

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Sun Oil Co. is building an $8 million, 100 million lb/yr naphthalene unit at its Toledo, Ohio, refinery, with completion planned by end-1961. It will be the largest petroleum naphthalene plant in the world.

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British Hydrocarbon Chemicals Ltd. has awarded a contract to Fluor Engineering & Construction Co. Ltd. to engineer and build a butadiene plant at Grangemouth, Scotland.

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Sinclair Petrochemicals Inc. will complete a unit to produce orthoxylene from mixed xylenes at Houston, in the second quarter of 1961, and has completed negotiations to supply a group of Japanese interests with 66 million lb/yr of the product over a three-year period. The orthoxylene is to be processed by Japan's two largest producers of phthalic anhydride, Kawasaki Kasei Chemical Industries Ltd., Tokyo, and Japan Catalytic Chemical Industry Co. Ltd., Osaka.

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Koppers Co. Inc. has expanded its alkylated phenol operations at Oil City, Pa. Among the first new products are para-tertiary butyl phenol; para-tertiary amyl phenol; di-tertiary amyl phenol; and both 2,4 and 2,6 di-tertiary butyl phenol.

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Tidewater Oil Co. and Collier Carbon and Chemical Corp. will build, as a joint venture, a 50 million lb/yr naphthalene plant at Tidewater's Delaware City refinery, Del., using a patented process developed by Union Oil Co. of California. Completion is expected by end-1961.

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Tennessee Oil Refining Co., a division of Tennessee Gas Transmission Co., will enter the petrochemical field with the construction of a 2,000 b/d aromatic solvents unit at Chalmette, La.

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Imperial Chemical Industries Ltd. expects to complete a 100,000 ton/yr, $28 million ammonia plant and associated units to make urea and fertilizers at its Severnside, Gloucestershire, England, works in 1963. ICI will also expand its 30,000 ton/yr methanol unit at the Heysham, Lancashire, works by an additional 45,000 ton/yr by 1962.

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Hooker Chemical Co. plans a multi-million dollar phenol plant in Kentucky, with completion at end-1961.

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Toa Nenryo, an affiliate of Stanvac, has proposed a $27 million petrochemical plant at Kawasaki, Japan, with completion by end-1961, if government approval is obtained.

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The Spanish government company, I.N.I., has asked Hoechst A.G. to join in a $70 million petrochemical plant at Puertollano, Spain.

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Hungary's petrochemical plants have a number of expansion projects planned. Tiszapalkonya will add 100,000 ton/yr of nitrogenous fertilizer capacity. Kazincbarcika will double in size and convert from coke to natural gas. Borsod Chemical Combine will construct a 15,000 ton/yr polyvinyl chloride plant. Tiszavidek Chemical Enterprise will build a 10,000 ton/yr polyethylene plant.

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Foster Grant Co. has awarded Scientific Design Co. a contract to design, engineer and construct a new Agfo Process polyethylene plant, the first in the USA. Plans are eventually to include polymerization and co-polymerization of propylene, butylene, and other hydrocarbons. The Agfo Process was developed by Imhico A.G. of Switzerland.

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Rhodiaceta, a subsidiary of Rhone-Poulenc, will build a 2.5 mmcf/d hydrogen plant near Lyon, France, the hydrogen to be made by reforming natural gas from the Lacq field. Chemical Construction Ltd. has the contract for design, engineering, and construction, with completion expected next year.

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Electro-Chemical Co. plans an $80 million plant at Goi, Japan, to operate on feedstock from Maruzen Oil. Construction will start in 1961 and is planned over an eight-year period. Products planned include ethylene, polyethylene, chloroprene, ethylene glycol, ethylene oxide, acetaldehyde, vinyl acetate, acetic acid, methanol, toluene, styrene, phthalic anhydride, and caustic soda.

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Texaco Canada Ltd. will complete in 1961 a new $2 million benzene and toluene unit at Port Credit, Ont. The project will include a low pressure catalytic reformer, a Udex extraction unit, and auxiliaries, with initial throughput of 1,500 b/d. Provision is being made for future production of xylenes and ethylbenzene.

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Phillips Carbon Black Ltd., a new company owned 30% by Duncan Bros. & Co. Ltd. of Calcutta, 30% by Phillips Petroleum Co., and 40% subscribed by private investors, will complete in 18 months a new 22 million lb/yr carbon black plant near Durgapur, India, using Phillips' basic process but operating on coal tar distillates.

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Many Petroleum Topics

(*Continued from page 53*)

(USA) on the mechanism of aromatization over chromia-alumina catalysts.

Catalytic Processes. There was a miscellany of practical papers on catalytic processes of possible commercial interest. Veatch, Callahan, Milberger and Foreman (USA) described a process for the direct air oxidation of propylene to acrolein over a catalyst consisting of about 50% $Bi_9PMo_{12}O_{52}$ on silica gel. Operating conditions reported suggested optimum operation at about 850F, near atmospheric pressure, contact time between 1 and 10 seconds, air/propylene ratio of about 9. About 3 to 5 mols steam per mol of propylene are added for "promotional" effect. Single pass conversion of propylene to acrolein of about 55% was attained.

Murakami and Shiba (Japan) reported studies on the modification of the alumina used to catalyze the production of acetonitrile from acetylene and ammonia. Yields as high as 99% were reported. The mechanism is considered to consist of dissociatively-adsorbed ammonia reacting with adsorbed acetylene.

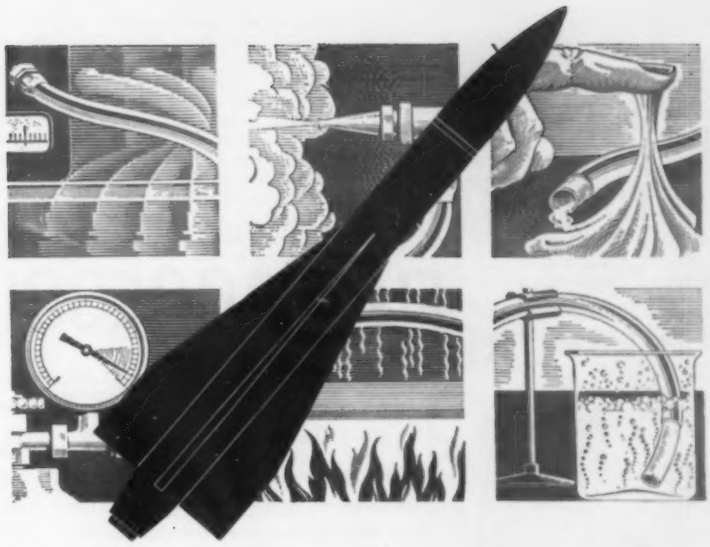
Zabor, Odioso, Schmid and Kaiser (USA) gave process data on the hydration of ethylene, propylene and n-butenes over tungsten oxide catalyst at about 3700 psig. About 70% conversion of ethylene to ethanol, 55% conversion of propylene to isopropanol and 13% of n-butene to butanol-2 was attained.

Mamedaliev and Huseinov (USSR) described a process for chlorination of light hydrocarbons to produce such products as carbon tetrachloride, tetrachloroethylene and hexachlorocyclopentadiene. The reactions occur in a fluidized bed of pumice at about 400C.

Air Pollution. There were two papers of interest in the field of air pollution. Sourirajan, Accomazzo and Nobe (USA) gave extensive data on the effectiveness of V_2O_5-Al_2O_3 and CuO-Al_2O_3 catalysts for the oxidation of trace concentrations of n-hexane. The CuO-Al_2O_3 catalyst was the more effective and, when tested on the exhaust gases from a two-cylinder engine using leaded gasoline, retained its activity for 100 hours. Sourirajan and Blumenthal (USA) followed with a paper on catalytic decomposition of nitric oxide since this, too, must be eliminated from exhaust gas for effective pollution control. CuO-SiO_2 was particularly effective as a catalyst; there was no apparent deterioration of effectiveness after 100 hours of test on a two-cylinder engine using leaded fuel.

Theoretical. Attempts to evolve a unified theory of catalysis appear to have slackened; only a few had the temerity to take the entire field as their province. The trend was to attempt to bring order into some small corner, with the evident intention of leaving for a later date the task of conquering all of chaos. Volkenstein (USSR) presented, in qualitative terms, an elaboration of his electronic theory of semiconductor catalysis that did so much to stimulate theoretical catalysis over the past decade. Dowden and Wells (Great Britain) suggested that crystal and ligand field

(*Continued on page 85*)



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Westinghouse F/A Motors also provide: (1) quiet operation through stator isolation from housing; (2) Thermalastic® insulation, exclusive in all Westinghouse large motors, for extended service and coil protection; (3) cables through base, eliminating conduit boxes and making connection of motor leads easy.

F/A Motors are available in a full line of squirrel cage, wound rotor and synchronous types with ratings from 250 hp to 7,000 hp. For full information on these and other Westinghouse motors from 1 to 250 hp, see your Westinghouse distributor. Or write for bulletin 60-B, Westinghouse Electric International Co., 40 Wall Street, New York 5, U.S.A.

theory may find application in relating the similar patterns of activity of metals, metal oxides and sulfides, and of metal ions in solution; the catalytical properties of the elements of the first long period were treated as an example. Gray (USA) presented a qualitative analysis of the electron transfer process occurring at catalyst surfaces, using data from photo-stimulated adsorption to supply corroborative evidence.

Schuit, Reijen and Sachtler (Netherlands) considered the catalytic activity of metals to be derivable from the heats of adsorption of reactants and products and the stability of the activated complex on the bare metal. The stability of the activated complex was taken to be relatable to the heat of sublimation of the metal, implying rupture of metal-metal bonds. Heats of adsorption were approximated by the heats of formation of the three-dimensional analogs of the two-dimensional adsorption complexes. It was shown, for example, that the relative activity of metals for C_2H_6-D_2 and NH_3-D_2 exchange and for hydrogenation of ethylene and acetone are correlatable with the heats of sublimation of the metals.

Yoneda and Saito (Japan) attempted to de-emphasize the role of adsorption. Catalysts were assumed to enter into the reaction through a series of elementary steps and various empirical relationships were noted between the heats of the elementary reactions and catalyst suitability. All in all, the papers on theoretical catalysis offered little hope that theory would soon predict new catalysts; it was much too busy trying to explain and understand existing catalysts. Present day theories lead to improvements rather than innovations.

The papers presented before the Congress ran the full gamut from highly theoretical to highly practical. Much of the meeting was devoted to attempts to explain and understand the practical in terms of the theoretical. Great progress has been made in the four years since the first Congress; much remains to be made. END

NEW PUBLICATIONS

Tanker Directory of the World, 1960, edited by Leonard G. Fay and published by Terminus Publications, Ltd., Rosebery House, Bream's Buildings, Fetter Lane, London, E.C.4, England. 310 pages, illustrated, bound in turquoise blue cloth. Price 60s. ($12) post free to any part of the world. This second edition has been thoroughly revised and the directory section enlarged. Two new features are statistical information on the world's tanker tonnage, and a list of tankers in groups of descending order of deadweight tonnage. The first section of the book, covering 66 pages, consists of a dozen articles by well-known personalities in the sphere of tank shipping. The directory section occupies a total of 210 pages and includes a complete alphabetical list of tankers over 400 tons deadweight, giving the flag, owners, tonnage, type of propulsion, builders and year built (this comprises over 4,100 ship entries); and a complete alphabetical list of tanker owners and/or managers, their addresses and their fleets.

Elements of Petroleum Reservoirs, a new book for investors, managers, supervisors and engineers. This 260-page book was written by Norman J. Clark and published by the Society of Petroleum Engineers of AIME. Featuring 174 illustrations, Mr. Clark has written the book for the non-reservoir engineer who seeks a basic understanding of petroleum reservoirs. The material is presented in a narrative, novel-like style, free of mathematics and physical formulas. Included are treatments of secondary recovery processes, operating oil reservoirs for maximum profits, use of natural reservoir energy, how pressure-production trends affect recovery in oil wells, how efficient rates of production may be determined, etc. Copies may be obtained for $7.00 from Society of Petroleum Engineers, 6300 North Central Expressway, Dallas 6, Texas.

Stratigraphic Principles and Practice, by J. Marvin Weller, 726 pages, $10.00. Harper & Brothers, 49 East 33rd St., New York 16, N. Y. One of Harper's geoscience series, Prof. Weller's new book is a thoroughly comprehensive and well-balanced account of those features of sedimentology, paleontology, tectonics and their problems that apply particularly to stratigraphy. The presentation emphasizes the interpretation of sedimentary rocks via information from studies in these collateral fields and leads to the reconstruction of geologic history, the goal of all geologic investigation. The book deals with the fundamentals of stratigraphy, rather than the details or the interrelations of specific stratigraphic sections. Thus it includes a thorough consideration of stratigraphic relations and their significance, an explanation of accepted practice in the classification and nomenclature of stratigraphic units, and a discussion of correlation problems. The book has been well illustrated and thoroughly indexed. Bibliographies follow each chapter.

Mineral Equilibria, by Robert M. Garrels, 254 pages. $6.00. Harper & Brothers, 49 East 33rd Street, New York 16, N. Y. This book is devoted largely to chemical relations in aqueous solutions at low temperatures and pressures. It is designed to introduce the reader to ways of representing mineral equilibria, with special reference to the development of partial pressure and pH-potential diagrams. The detailed development makes the book very well suited to use by the general reader, the professional, and the student. An appendix contains selected values of free energy of formation of various compounds and ions of particular interest to geologists, and a bibliography on the use and development of the diagrams is presented.

Fluidization and Fluid-Particle Systems, by Frederick A. Zenz and Donald F. Othmer, 514 pp, $15.00. Reinhold Publishing Co., 430 Park Ave., New York 22, N. Y. Cover modern developments in fluid-solids processing, including moving bed techniques, fluidization, and transport reactors. New, unpublished material has been included and the entire subject matter is arranged in logical sequence.

Acrylic Resins, by Milton B. Horn, 184 pp, $4.50; *Polyester Resins,* by John R. Lawrence, 252 pp, $5.75; and *Metallizing of Plastics,* by Harold Narcus, 208 pp, $5.50. These books, all published this year and all a part of Reinhold's continuing Plastics Applications Series, are worthwhile additions to the shelf of anyone concerned not only with the manufacture of finished plastics but also with the production of the raw materials from which plastics are made. Each brings together a concise discussion of the subject plastic, its history, chemistry, properties, manufacture, fabrication and applications, and—in some instances—information of testing techniques and the like. Published, 1960, Reinhold Publishing Corp., 430 Park Avenue, New York 22, N. Y.

Pipe Cleaning And Coating

Crose-Perrault Equipment Corp., has developed a new internal pipe cleaning and coating machine. Only two basic cleaning heads are required for all pipe sizes from 16" through 36".

High speed circulars' wire brush assures optimum, efficient cleaning, and the retractable brush unit minimizes pipe entry damage. Brush pressure is indicated on operator's console and can be easily adjusted during operation to meet varying surface conditions.

The large capacity continuous operation vacuum pickup system removes rust and scale during cleaning and coating operations. This system also eliminates the problem of clouds of dust being blown back on freshly coated surfaces.

An airless type coating spray system utilizes hydrostatic pressure to atomize paint, eliminating 90% of overspray and coating bounce-back and resulting in a more uniform coating. Use of a 360-degree spray head prevents build up or lap at juncture of spray pattern.

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As the result of such intensive testing and constant improvement, you are sure of getting the ablest performers, incorporating the latest advances, when you specify Westinghouse motors. The Westinghouse Guardistor motor, for example, incorporates three tiny positive temperature coefficient thermistors in the windings themselves to provide positive protection against heat build-up regardless of cause – whether from overloading, inadequate ventilation, single phasing or other reason.

Similar advantages—all thoroughly proven in laboratory and field tests – enable Westinghouse motors in oil service everywhere to provide the highest standards of performance, reliability and economy.

INTERNATIONAL NEWS AND NOTES

Alaska—Standard of California has reported a second successful oil well in the Soldatna Creek field on the Kenai peninsula, southwest of Anchorage, Alaska. Located 60 ft from the company's discovery in the field, MER (maximum efficient flow rate) is reported as between 700 and 800 b/d, although the company has not confirmed this figure.

Angola—Angola's crude production in first quarter of 1960 was 13,398 metric tons (about 1,080 b/d), according to USA Dept. of Commerce. Petrangol refinery processed 28,751 tons in the same quarter—of which 16,256 was fuel oil, 71,193 gas oil, 4,051 gasoline, and 375 tons kerosine. The refinery has expanded its yearly capacity to 180,000 tons (3,600 b/d), and is now also producing butane.

Arabia—Crude run through the Trans-Arabian Pipeline to Sidon dropped drastically in the first quarter of this year, to 275,353 b/d. In the same period a year ago, receipts were 427,601 b/d. The average for all of 1959 was 337,985 b/d, of which 337,696 b/d was delivered to the refinery or ships.

The Iraq Petroleum Co. line to Tripoli carried 152,439 b/d as an average for last year, of which 1,360,397 b/d went to the refinery there. Another 55,815,068 b/d went to ships, for a total of 154,274 b/d of deliveries.

IPC's Tripoli refinery, with a capacity of 11,500 b/d, has been operating at 2,683 b/d in the first quarter of this year, against 4,932 b/d a year ago.

Australia—Within a few weeks tenders will be called on a $36 million refinery to be built, with government assistance, near Adelaide, in South Australia. Plan is to begin construction before year-end 1960 and to have plant in operation by the second half of 1962.

Australia—Imperial Chemical Industries of Australia and New Zealand Ltd is to build a $4 million pigments plant on the Truganina explosives reserve at Altona, Victoria. The plant will make a complete range of pigments for the plastics, paint, printing ink, and other color using industries.

Components of the plant will be largely Australian. The storage of explosives at the Truganina reserve will cease soon to make way for the plant. Establishment of the factory will be the first stage in starting an Australian dyestuffs industry. The area consists of 330 acres of low-lying land. It is understood the Altona Shire Council will strongly oppose the new pigments industry being established on the site.

Australia—Total Oil Products (Australia) has been established as a subsidiary of the French firm Cie. Francaise des Petroles. With initial $9 million capital, it will begin operations in the state of Victoria, which includes the city of Melbourne.

Australia—Australian imports of crude in 1959 were up 4% over 1958—with Qatar for the first time the leading supplier, displacing Iran which ranked third for the year, just behind Indonesia.

Indonesia continued to be the main source of refined products, with imports at about the 1958 level except for aviation turbine fuel, motor spirit (up 22%), and industrial diesel and furnace oils (down 57%).

Consumption of oil products rose by 8% in 1959, only significant decline being in aviation gasoline which fell by 13%.

Refinery production was 3½% higher than in 1958, but aviation turbine fuel alone jumped 62%. Production of industrial diesel oil fell by 23%, but still exceeded consumption, as did the output of automotive diesel oil and furnace oil.

Australia—Imperial Chemical Industries of Australia and New Zealand Ltd. is to build a $4 million pigments plant on the Truganina explosives reserve at Altona, Victoria.

Australia—A site about 1½ miles north of Port Campbell, Victoria, has been selected for a second oil test by Frome Broken Hill Co. Pty. Ltd. Partners in the venture are Interstate Oil Ltd., Vacuum Oil Co. Pty. Ltd., and BP Exploration Co. Ltd.

Australia—Wilton E. Worlow of Pipeline Technologists Inc., Texas, is to make a survey of a proposed 200-mile pipeline from Brisbane to Roma—first major pipeline in Queensland. At present oil products must be hauled by motor transport from Queensland ports to inland centers.

Austria—Austria has reported 95 deep wells were drilled in 1959 (75 in 1958)—with total footage 475,745 ft, or average 4,922 ft per well. Some wells went below 9,843 ft. Oemv (State company) drilled 30 exploratory wells; two oil, six gas, 22 dry holes. Producing wells drilled totaled 29, and extension 14. RAG drilled eight exploratory wells in Upper Austria province (four oil, four dry holes). Remaining footage went for water-injection wells. At year-end 1959, Oemv had 783 oil wells in production; RAG 81 (in Upper and Lower Austria); Van Sickle 49; most wells were pumping. Oemv also had 69 gas wells in production.

Austrian refineries processed 1.88 million tons of crude in 1959, against 1.82 million in 1958—increase coming from Soviet crude-oil deliveries.

Investment in the Austrian oil industry during 1959 totaled $26 million, against $40 million 1958.

Burma—Burma Oil Co. (1954) Ltd. has decided to shift operations of the Santa Fe Drilling Co.'s deep drilling National 80B outfit (under contract to Burma Oil) to Yenangyaung in central Burma from the Irrawaddy delta.

Denmark—Dansk Veedol Co., subsidiary of Tidewater Oil Co., has agreed to purchase an entire village, if necessary, to construct Denmark's first oil refinery. Permission to build the plant came after a four-week delay caused by concern expressed over possible air and water pollution from the plant. If pollution control measures failed, the company would purchase all buildings within a mile of the center of the refinery, which would include the entire village of Melby.

French Sahara—Second stage of the crude line from Hassi Messaoud to the port of Bougie is now in operation, and the line has a rated capacity of 1,380 cubic meters an hour or 9.3 million tons per year.

Germany (West)—The pipeline which will be constructed to link with Bavaria the end of the large Marseilles-to-Germany line from the latter's northern terminus at Karlsruhe (see *WPR* 6-1-60) will be a 160-mile 22-in. 80,000 b/d link. The eight refining

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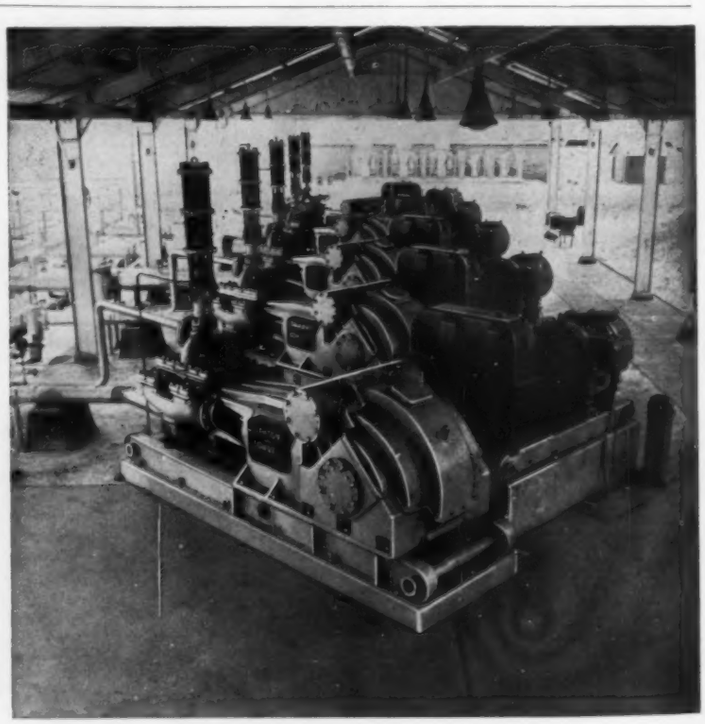

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and marketing companies involved include British Petroleum, Esso, Shell, Deutsche Erdoel, Gelsenberg/Benzin, Mobil, Schloveb-Chemie, and Wintershall.

French Equatorial Africa—During May 1960, Ste. des Petroles d'Afrique Equatoriale produced 67,800 tons; for the first five months of 1960, production reached 333,200 tons—43,000 tons over the comparable 1959 period. Four tankers loaded in May at Cape Lopez, carrying a total of 75,400 tons of crude. Since the beginning of exploitation of the Gabon fields in 1957, production of SPAFE has reached 1,768,000 tons.

India—India has decided to build a 20,000 b/d refinery somewhere in southern India to refine Soviet crude. The third such in the public sector, the proposed facility will probably go into production in 1962 under the third Five-Year Plan (1966). Negotiations between India and Russia covering details of importing Russian crude are nearly complete. The Indian government may also ask the Soviets to help build the proposed refinery. Russia and Romania already are assisting in the construction of two other State-owned refineries.

India—A trade mission which recently left India for Moscow will negotiate for purchase of Russian oil drilling equipment, and will attempt to recruit more Russian personnel for oil exploration during India's Third-Year Plan.

India—A new oil find, said to be the best so far discovered in India's public sector, has been struck at Ankleshwar, about 100 miles from Cambay town. Second Cambay discovery in recent months with Soviet assistance, the new Ankleshwar find is reported superior in quality and quantity to the first which has already been reported "commercial."

India—Local sources report Standard-Vacuum has been negotiating with the Indian government for establishment of a lubricating-oil plant on the country's west coast, on a 50-50 basis.

Stanvac's capital outlay for Indian operations during the past 10 years have totaled 162 million rupees. In 1959, its outlay for exploration, refining, and marketing was some 29.7 million rupees, of which 10.6 million went for exploration, 10.2 million for expansion of the Trombay (Bombay) refinery, and 8.9 million for marketing.

Indonesia—Crude output in Indonesia reached 139,038,000 bbl in 1959, about 15% above the level of 121,523,000 bbl in 1958. The output was a record high for each company, but the output of Stanvac's South Sumatran field and Shell's Java fields dropped in the year. Here are the crude-oil output figures by companies:

	1959 (Thousands of barrels)	1958
Stanvac		
S. Sumatra	18,835	20,189
C. Sumatra	11,607	7,542
	30,442	27,731
Shell (Inc. Permindo)		
S. Sumatra	34,762	29,064
Borneo	6,673	6,013
Java	1,748	2,087
	43,183	37,164
Caltex		
Minas	53,933	
Duri	6,519	54,454
Other	17	
	60,469	
Permina	4,573 (estimate)	1,825 (estimate)
PTMRI	371	349
TOTAL	139,038	121,523

Iraq—Effective June 15, BP Trading Ltd. posted an additional grade of Iraq crude available at Tripoli (Lebanon). This designated "Iraq (Mediterranean) export grade 'B' (Jambur-Hassan blend)" and is priced at $2.20 per bbl for 34.0-34.9 API gravity crude. The 36.0-36.9 grade previously termed "Tripoli (Lebanon) or Banias" is redesignated "Iraq (Mediterranean) export grade 'A.'"

Iran—The SIRIP operation, a joint venture of Iran and a subsidiary of ENI, the Italian State oil agency, has been making only 20 meters daily in drilling at Sekuteh in the central Zagros mountains. Cold weather was a problem for some time, and hard rock has been met. Plan is to go to 4,000 meters; the depth was 1,900 meters late in April. A truck brings in supplies each two days over a road the Italians keep passable.

Iraq—The Directorate General of Oil Affairs has been removed from control of the Iraqi Petroleum Commission, and will become part of Ministry of Oil. Qasim Ahmad al-'Abbas has been appointed acting director general of oil affairs in place of 'Abd al-'Aziz al-Wattari.

Ireland—The Irish Refining Co. Ltd., Whitegate, Ireland, reports crude throughput of 2,477,198 bbl in the first three months of 1960. Crude imports in the quarter came to 84,266,021 imperial gallons, about 60,000,000 of it from Iraq and the rest from Saudi Arabia.

Israel—The 16-in. 264-mile crude pipeline from Elath, at the head of the Gulf of Aqaba, to the Haifa refineries on the Mediterranean began operation in June. Slated for an ultimate capacity of 120,000 b/d, in its early stages the line will carry less than half this quantity.

Italy—Associazione Rafinerie Petrolifere Indipendenti (Independent Oil Refiners' Assn.) has been formed in Rome, whose members are Italian refining companies without indigenous crude sources and not affilated with international oil companies. Because of the keen competition from the State-owned ENI and from Italian subsidiaries of the major companies, ARPI includes among independents all smaller but complete refineries.

The following are ARPI members, with capacities in parentheses: DICA (143,000 tons per year); Volpato (70,000); ILSEA (90,000); IPLOM (160,000); Lombarda Petroli (200,000); Nuova Raffineria Nilo (514,500); Societa Petrolifera Italian (260,000);

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A Paxman 'Drilpak' 400F, the world's most advanced packaged power unit, for drawworks and slush pump drive.
A compact Paxman 8RPHM marine propulsion diesel, developing 340 s.h.p. at 1500 r.p.m.
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Sanquirico (220,000 tons per year). Their combined capacity amounts to 1,667,000 tons per year (33,360 b/d), with members planning expansion of their existing plants.

Japan—Sinclair Petrochemicals Inc., a subsidiary of Sinclair Oil Corp., has announced completion of negotiations to supply Japanese interests with orthoxylene over a three-year period. A Sinclair affiliate will construct a new petrochemical unit to produce orthoxylene from a mixed xylene stream at its Houston, Texas, refinery. Initial production and first deliveries are scheduled for the second quarter of 1961.

Sinclair has contracted with the Japanese trading companies, Mitsubishi International Corp., Nissho American Corp., Ataka New York Inc., and Toyomenka Inc., for a total quantity of 66 million pounds per year of orthoxylene which will be processed by the two largest producers of phthalic anhydride in Japan, the Kawasaki Kasei Chemical Industries Ltd., in Tokyo; and Japan Catalytic Chemical Industry Co. Ltd., in Osaka.

Orthoxylene is a raw material for the manufacture of phthalic anhydride, a basic ingredient in the manufacture of alkyd paints, vinyl plastics, dyes, and polyester resins.

Kuwait—Chicago Bridge & Iron Co.'s British subsidiary is building the world's largest crude-oil storage tank in Kuwait for American Independent Oil Co.; capacity is 605,000 bbl.

Libya—Oasis Oil Co. of Libya Inc., a new company has been formed to conduct combined future exploration, development, and transportation for Ohio Oil Co., Amerada, and Continental Oil. The new firm will not engage in refining or marketing, the three parent companies going their separate ways.

Libya—A total of 100 wells has been drilled in Libya; 26 have produced oil, with one gas producer. Rated production is 63,675 b/d of oil and 10 million cubic feet of gas daily. At present, about 27 drilling rigs are in operation, and five are either moving to new locations or awaiting repairs.

Thirty wells (total) are in various stages of being drilled including reaming, running casing, coring, whipstocking, logging, attempting to regain circulation, or washing-over.

By companies, the 30 wells breaks down to: Oasis, 12 wells drilling; Esso, four drilling and one abandoned; Mobil, two drilling and one abandoned; Shell, three drilling; Amoseas, two drilling and one suspended; BP, two drilling; CPTL, two drilling; Gulf, two drilling; Nelson Bunker Hunt, one drilling.

Forty seismic parties are at work, and 10 are resting.

Libya—Libyan completions by Oasis Oil Co. include two extensions of the Dahra field. F-7-32 (Block 32) flowed 2,000 b/d of 42-gravity oil from around 3,150 ft; and F-8-32 was completed around 3,210 ft (potential not reported). The field had seven producers. A recent well flowed over 11,000 b/d, making eight producers.

Mali (West Africa)—The Mali Federation of Dakar and Senegal has formally gained its independence from France. Previously, under a French community program, Paris remained responsible for Mali defense, diplomacy, and external finance. Madagascar will receive its independence in July, and other areas are slated to follow.

Mauritania (West Africa)—A consortium of one French and two American companies has been awarded a five-year 38,477-square-kilometer exploration concession in the republic of Mauritania, on Africa's west coast just south of the Spanish Sahara region of Rio de Oro. The French firm Petropar holds 51% as operator. Continental Oil Co. of Mauritania participates 25%, and Mauritania Cities Service 24%. The two American partners share a similar operation with the French in Senegal.

Nadir—So deep is the depression gripping the ocean-going tanker business that it is reported demand has dropped from the post-Suez tanker-building spree to the point where a Japanese shipyard is now selling on these terms: down payment, 2%; 3% in one year; 7½% on keel laying; 7½% at launching; 10% on delivery; and the remaining 70% over six years.

Pakistan—Chairman of Burmah Oil Co., in London, has announced the discovery of natural gas at Kandhkot, southeast of Pakistan's Sui gas field.

Sui well No. 7, spudded early in May, was drilling below 4,230 ft at the beginning of June; it is projected to 4,400 ft.

Portuguese Guinea—Esso Exploration Guiné Inc. has awarded Drilling & Exploration Co. a contract to furnish supervision and technical skill for the drilling of several exploratory wells in Portuguese Guinea, West Africa. Equipment will be shipped from Malta, and will arrive at the port of Bissau on Africa's west coast about October 1. This marks commencement of oil and gas exploration activity in Portuguese Guinea.

Romania—Romania's draft of the new six-year plan (1960-65) again confirms that crude production is stagnating. Output is to rise only 7%, to 12.2 million tons in 1965, from 11,438,000 tons in 1959. The figure for 1965 is 1.3 million tons short of the target set in the current five-year plan for 1960 (13.5 million tons)—a target which will probably not be reached. Other sectors of the oil industry will make faster progress. Gas yields is to increase 2.3 times, to 469,-623 million cubic feet in 1965, from 204,162 million cubic feet in 1959. During the same period, output of drilling units is to increase 1.9 times, to 135-140 units from 72 in 1959. Oil extraction is to become more economic; old rigs are to be replaced by modern ones capable of reaching greater depths; the share of turbine drilling is to rise to 70% of all drilling operations; drilling speed is to increase by 40%; and secondary-recovery methods are to be applied on a wider scale. Casinghead gas is to be utilized 95%, and all its gasoline is to be recovered. The plan also provides for the laying of 900 miles of gas pipeline, bringing the total length of gas lines in 1965 to 2,484 miles.

Saudi Arabia—Saudi Arabian Refinery Co. (SARCO) has signed contracts for design, construction, and operation of a $20 million 20,000 b/d refinery on the Saudi Arab coast southwest of Jiddah. To on-stream before year-end 1962, Ralph M. Parsons (Los

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Angeles) has been awarded contracts. SARCO is reported having obtained a 40-year concession from the Saudi government, renewable for an additional 40 years.

Spanish Sahara—A number of early "strats" will be drilled by Gulf Oil Corp. on Blocks 47 and 51, central Spanish Sahara.

Sudan—Ballerini Spa, of Piacenza, Italy, will supply four rigs to the Sudanese government at Khartoum at a cost of $610,000. The Italian company won the award because its bid was 10% lower than American bids, according to Italian sources.

Switzerland—British Petroleum's first deep test, Courtion No. 1, in the canton of Fribourg, Switzerland, is being drilled about 10 kilometers northwest of the city of Fribourg under BP's contract with Ste. d'Interets Miniers SA. It is anticipated BP Exploration SA Fribourg will follow this up with a second test.

Thailand (Siam)—A French industrial group is reported to have been awarded a $12.2 million contract for building a new refinery in Thailand. Companies include Petro-Fuga and Forges et Ateliers de Commentry-Gissel.

Tunisia—Moroccan Embassy confirms unofficially completion by ENI (Italian State entity) of a substantial discovery at Omu-Douli, northeastern Tunisia, about 36 miles east of the city of Tunis.

USSR—Kortunov, chief of administration of the USSR gas industry, declared recently that the USSR this year will overtake the USA in the absolute annual rate of increase in gas production. In 1980, the USSR is to produce 50% more gas than the present yield in the USA. 1959, he said, was a record year for the USSR in two respects: 18 new gas deposits were discovered, and their volume of extractable gas was almost as great as that discovered during the whole history of gas exploration in Russia.

UAR (Syria)—GPA (General Petroleum Authority-Syrian Branch) has budgeted five projects for new financial year: (1) completion of deep test drilling in Petra and Tal-Rumailan areas in Karcahuk under Contract No. 944; (2) studies of possible natural-gas utilization from producing fields; (3) production of lubes at Homs refinery; (4) expanded bitumen production at Homs; (5) expanded oil-storage facilities in the main cities of Syria.

USSR—Czechoslovakia, Hungary, and Poland have recently signed long-range trade agreements with the Soviet Union to secure the import of crude and products. Czechoslovakia imported last year from the USSR 1,670,000 tons of crude and products; in the period 1961-65, 22 million tons of crude are to be delivered. Imports of products will decrease due to the completion of Czechoslovakia's largest refinery, at Bratislava. Hungary received last year 1.2 million tons of crude; during 1961-65 it is to receive 6.6 million tons. Poland imported last year from the USSR 690,000 tons of crude and 1.5 million tons of products. The agreement for 1961-65 provides for 8.5 million tons of Soviet crude and 7.7 million tons of products.

USSR—West Germany's Krupp concern is at present constructing three chemical plants in the Soviet Union: (1) one at Novo Kuybyshevsk, near Kuybyshev, for production of paraxylene from xylene, a byproduct of crude distillation; (2) one at Stalinogorsk, 155 miles south of Moscow, for production of dimethylterephtalat from paraxylene, used as a raw material for synthetic fibers; (3) one at Kursk, 310 miles south of Moscow, where the raw material will be spun into yarn.

USSR—Since 1958 experiments with an electrothermal gaslift method for the recovery of oil from depleted horizons have been carried out in the Soviet Union. Edectric tension of a certain voltage creates in oil-bearing structures a zone of high temperature. If air is pumped into this zone, a fire begins to smolder, progressing with a speed of 0.078 in., 0.195 in. per minute. The temperature rises to 1,382 F., generating gases whose pressure lifts the oil to the surface. For maintenance of the fire, 17 to 20% of crude is consumed while the recovered volume of crude amounts to 50 to 55%.

United States—Gulf Oil Corp. has appealed a federal court's summary judgment which rejected Gulf's complaint seeking a change in the regulations governing import quotas for residual fuel oil. Gulf contends the complaint "presents issues of public importance which should be determined upon a full and complete record," and asks for a reversal of the decision and a return of the case to the court for further proceedings.

World—Dr. L. C. Weeks (former SONJ chief oil geologist) has upped to 2,000 billion barrels his 1959 forecast of 1,900 billion barrels for the world's ultimate recoverable oil reserves. In the 1940's Dr. Weeks's estimate was only $10 billion barrels.

Yugoslavia—Yugoslavia's largest oil field to date and its first pipeline began operation recently. Struzec, discovered in 1957, has reserves of 16 millions of light oil. Five collecting stations have been built, and an 11-mile pipeline has been laid to Sisak refinery and the Sava River oil port. By the end of 1960, Struzec is to produce 310,000 tons. Total Yugoslavian crude output for the year is to increase to one million tons (20,000 b/d) from 592,485 tons in 1959. By 1961 Yugoslavia expects to be independent of crude imports.

U. S. Gas Use Up

At the beginning of 1960, gas consumption by the 32.1 million customers (in 1959) of the more than 400 USA investor-owned gas utilities was forecast at 91.1 billion therms for the year, against actual 87.4 billion therms in 1959. (A therm is a measure of heat). The Am. Gas Assn. expects the number of these customers to rise to 33.2 million by year-end 1960, and consumption to rise by 3% over the original 91.1 billion figure.

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1⅜"	2"	110	700'	790'		
1⅞"	2"	205	340'	430'	490'	580'
2⅜"	2½"	363	175'	265'	310'	400'
3"	3½"	565	80'	170'	140'	250'

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JENSEN JACKS

World Petroleum Statistics

FREE WORLD SUPPLY AND DEMAND, CRUDE AND PRODUCTS, NOVEMBER, 1959
(Thousands of barrels)

Source: USA Bureau of Mines, Division of Petroleum.

Country	CRUDE PETROLEUM: Production	Imports	Exports and reexports	Stock change, other demand, and loss	Total 1/ refinery input / Total 2/ refinery output	REFINED PRODUCTS: Imports	Exports and reexports	Apparent domestic demand (incl. bunkers)	Bunkers-all flags (as reported)
NORTH AMERICA									
Canada	14,384	10,023	2,577	+232	21,918	4,829	157	3/26,881	
Mexico	7,814	-	-	+15	8,401	526	790	8,137	
United States (incl. Alaska)	209,449	29,421	132	-779	253,881	25,458	5,453	3/299,747	6,166
Subtotal	231,587	39,444	2,709	-532	284,200	30,813	6,400	330,765	
CENTRAL AMERICA AND CARIBBEAN									
Costa Rica	-	-	-	-	-	E/ 95	-	95	
Cuba	14	2,416	-	+228	2,202	E/366	-	2,568	
Dominican Republic	-	-	-	-	-	E/165	-	165	
El Salvador	-	-	-	-	-	E/144	-	144	
Guatemala	-	-	-	-	-	E/249	-	249	
Haiti	-	-	-	-	-	E/ 72	-	72	
Jamaica	-	-	-	-	-	751	-	751	
Nicaragua	-	-	-	-	-	E/ 90	-	90	
Panama, Canal Zone	-	-	-	-	-	552	138	414	406
Panama, Republic	-	-	-	-	-	E/175	-	175	
Puerto Rico	-	2,423	-	+38	2,448	299	1,421	1,326	
Subtotal	14	4,839	-	+266	4,650	2,958	1,559	6,049	
SOUTH AMERICA									
Argentina	3,858	2,777	-	+322	6,334	1,414	-	3/6,568	115
Bolivia	269	-	85	-5	189	15	-	204	
Brazil	2,063	3,640	976	+245	4,482	E/3,324	-	7,806	
Chile	563	204	-	+16	762	E/595	-	1,357	
Colombia	4,360	-	2,668	-20	1,786	-	533	3/1,513	
Ecuador	214	-	-	-32	246	38	-	284	
Netherlands Antilles	-	19,719	-	-3,084	23,936	E/1,496	E/19,361	3/6,131	
Paraguay	-	-	-	-	-	E/ 48	-	48	
Peru	1,500	-	174	-30	1,417	154	137	1,434	27
Trinidad	3,474	1,409	-	-822	5,747	E/158	E/4,447	3/1,458	1,130
Uruguay	-	498	-	-39	537	486	-	1,025	
Venezuela	85,041	-	59,051	-230	26,220	E/ 47	E/22,916	3/3,904	1,466
Subtotal	101,342	28,247	62,954	-3,729	72,296	7,777	47,394	31,732	
WESTERN EUROPE									
Austria	1,376	226	552	+35	1,048	501	59	3/1,694	
Belgium and Luxembourg	-	4,803	-	+134	3,833	1,731	1,207	4,357	
Denmark	-	-	-	-17	17	2,913	3	2,985	153
Finland	-	618	-	+18	E/600	557	-	1,157	
France	1,046	17,076	-	-1,287	19,409	1,044	4,363	3/16,135	846
Germany, West	3,123	9,261	-	-1,484	13,868	2,460	1,813	14,515	
Greece	-	1,089	-	+420	669	250	-	919	
Iceland	-	-	-	-	-	144	-	144	
Ireland	-	655	-	-108	763	120	-	883	
Italy	1,114	15,107	467	-914	16,735	682	4,615	3/11,874	1,036
Netherlands	1,014	7,676	-	+501	8,918	3,993	4,561	8,350	562
Norway	-	526	-	+37	69	1,771	-	1,846	
Portugal	-	630	-	-255	885	497	108	1,274	
Spain	-	2,485	-	-56	E/2,594	100	-	2,694	
Sweden	-	1,892	-	+132	E/1,760	6,716	66	8,410	
Switzerland	-	-	-	-	-	1,617	-	1,617	
United Kingdom	61	23,691	-	+65	23,687	7,464	4,319	3/28,013	2,528
Yugoslavia	373	E/400	-	+79	694	E/ 70	E/ 46	718	
Subtotal	8,107	85,115	1,017	-2,400	95,549	32,636	21,162	107,525	
MIDDLE EAST									
Aden	-	3,033	-	+80	2,953	732	1,880	3/1,805	1,140
Bahrain	1,356	4,379	-	+146	5,589	-	5,823	1,666	346
Iran	29,813	-	18,552	-254	E/11,007	-	7,744	3,263	
Iraq	27,105	-	E/26,079	-	E/1,026	E/ 2	-	1,028	
Israel	60	E/690	-	-	E/750	E/977	-	1,727	
Jordan	-	-	-	-	-	E/ 96	-	96	
Kuwait	41,103	-	36,659	+764	3,680	-	1,806	3/1,874	1,435
Lebanon	-	445	-	-	E/445	E/ 28	-	473	
Neutral Zone	3,671	-	2,636	-125	E/1,160	-	E/900	660	
Qatar	4,756	-	E/4,740	-	E/ 16	-	-	16	
Saudi Arabia	36,309	-	28,750	+1,680	5,879	4	4,043	3/1,828	
Turkey	231	-	-	+50	181	1,360	-	1,541	
U.A.R., Syria	-	E/457	-	-	E/457	89	-	546	
Subtotal	144,404	9,004	117,416	+2,849	33,143	3,298	21,796	15,523	
AFRICA									
Algeria	1,918	-	389	+1,533	-	615	-	3/632	
Angola	35	E/ 41	-	-	76	77	-	153	
Belgian Congo	-	-	-	-	-	327	-	327	
Canary Islands	-	E/1,763	-	-67	E/2,024	E/ 46	E/1,431	639	
Ethiopia	-	-	-	-	-	E/ 57	-	57	
States formerly in French Equatorial Africa	443	-	689	-246	-	E/ 80	-	80	
French West Africa	-	-	-	-	-	E/339	-	339	
Ghana	-	-	-	-	-	E/305	-	305	
Kenya	-	-	-	-	-	E/353	97	256	
Liberia	-	-	-	-	-	E/ 32	-	32	
Madagascar	-	-	-	-	-	87	-	87	
Morocco	67	E/ 22	-	-	89	864	-	3/488	
Nigeria	480	-	443	-23	-	398	-	398	
Rhodesia & Nyasaland	-	-	-	-	-	E/323	-	323	
Sudan	-	-	-	-	-	369	-	369	
Tanganyika	-	-	-	-	-	E/165	34	131	
Tunisia	-	-	-	-	-	257	-	3/292	
Uganda	-	-	-	-	-	E/ 99	15	84	
Union of South Africa	-	667	-	-79	746	1,412	354	1,804	
U.A.R., Egypt	1,842	E/693	735	-	E/1,800	E/1,030	E/ 12	2,818	
Subtotal	4,725	3,186	2,252	+1,118	4,735	6,629	1,943	9,608	
SOUTH ASIA, FAR EAST, AND OCEANIA									
Australia	-	7,356	-	+598	6,758	813	878	6,693	632
British Borneo	8,255	-	1,767	-	E/1,488	E/ 59	E/1,807	340	
Burma	307	-	-	+14	293	E/ 65	-	358	
Ceylon	-	-	-	-	-	601	-	601	
India	255	E/3,052	-	-	E/3,307	E/3,668	E/ 29	6,946	
Indonesia	11,785	E/935	6,208	-	E/6,833	E/122	E/5,105	1,850	
Japan	264	13,837	-	-78	14,179	E/461	153	16,487	
Korea, South	-	-	-	-	-	99	-	3/564	
Malaya and Singapore	-	-	-	-	-	3,131	1,365	1,766	
Netherlands New Guinea	128	-	E/128	-	-	-	-	Insig.	
New Caledonia	-	-	-	-	-	E/ 31	-	31	
New Zealand	-	-	-	-	-	1,010	-	1,010	
Pakistan	210	-	-	-7	217	E/1,335	-	1,552	
Philippines	-	595	-	-175	770	E/562	-	1,332	
Taiwan	2	656	-	+146	512	663	-	1,175	
Thailand	-	-	-	-	-	472	-	472	
Vietnam, South (incl. Cambodia)	-	-	-	-	-	E/461	-	461	
Subtotal	16,146	26,431	8,103	+496	34,357	15,553	8,737	41,638	
WORLD TOTAL EXCLUDING EASTERN EUROPE, U.S.S.R., & MAINLAND CHINA	506,325	196,266	194,451	-1,930	528,930	99,654	108,991	542,840	

E/ Estimate based on latest available data.
1/ Total input includes crude runs to stills plus runs of other unfinished oils, topped crude and natural gas liquids blended.
2/ Total output includes refined product output plus refinery fuel and loss.
3/ Domestic demand as reported, including stock changes.
4/ Apparent domestic demand is heavily influenced by refinery fuel and losses, bunker loadings, and stock changes.

U. S. Demand Up 3.7%

Bureau of Mines forecast oil demand in USA in July 1960 as 6,995,000 b/d, against 6,870,000 b/d in June. Revised estimate of domestic demand of all oils for 1960 is 9,796,000 b/d, 3.7% over 1959 actual. The gain in domestic demand for the first half of 1960 over 1959 is 2.6%, while a gain of 4.7% is forecast for the second half. Demand in the first half of 1959 was low because of decline in general industrial activity resulting from the steel strike and warmer than normal weather in the fourth quarter.

U. S. Court Rules On Gas

Among recent rulings of the US Supreme Court was an unanimous decision that federal courts have power to make their own interpretations of the meaning of natural-gas supply contracts, provided they do not get into narrow technical issues within the "special competence" of the Federal Power Commission. This ruling rejects a government request that the justices firmly establish the principle that interpretation of rate contracts is the FPC's job, not the job of the courts. The highest court also agreed to decide (but probably not before 1961) if state courts have power to modify natural-gas rates which have been accepted, at least tentatively, by the FPC.

U. S. Oil Imports To Drop Again

With a further drop expected this year, exports of crude and products declined to average 240,000 b/d in 1959 from 430,000 b/d in 1956, according to IPAA. In the same period, imports increased to 1,780,000 b/d from 1,436,000 b/d. Despite federal controls, imports in the first three months of 1960 held above 1,900,000 b/d, partly because of the heavy shipments into the USA of residual fuel oil.

U. S. Offshore Claims Settled

Texas and Florida are winners in Supreme Court findings; Louisiana, Alabama, and Mississippi are losers—and Louisiana is hit hardest of all. The US Supreme Court has ruled the federal government owns the oil-rich submerged lands beyond the 3½-mile limit off the coast of Mississippi, Alabama, and Louisiana; but it has granted Texas and Florida control of the so-called "tidelands" all the way out to the 10½-mile limit. The decision gives the federal government, Texas, and Florida $308 million in royalties from oil and gas companies, plus the right to future royalties. Oil men said they are relieved, as th offshore ruling ends confusion over the growing exploration area.

The high court's ruling—unless changed by Congress—gives the federal government the bulk of the $308,400,000 of escrowed royalties collected from the oil companies operating in the tidelands off Louisiana, plus the right to gather much more in future

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royalites. While this and future amounts would not bulk large in federal revenues, it is a serious loss to Louisiana and potentially an incalculable future loss to all of the five coastal states. As to Florida, Alabama, and Mississippi, as of now, development of potential offshore oil deposits have been minor—so much so that no records are available as to production or reserves.

Lawmakers from Louisiana, Alabama, and Mississippi are reported plotting a 1961 drive for legislation to overturn the Supreme Court ruling against the three states' claims to offshore oil lands.

New Sun Marketing Co.

Formation of Sunoco Trading Corp., as a wholly-owned subsidiary has been announced by Sun Oil Co. Incorporated in Delaware, it will engage in the purchase and sale of crude oil and petroleum products on a world-wide basis. President of the new corporation is Charles B. Duke, director of the crude oil purchase and sales division of Sun Oil Co.; vice presidents are D. E. Norris and Paul E. Macht, both formerly assistant directors of Sun's crude oil purchase and sales division; secretary and treasurer is Joseph T. Wilson, Jr., assistant secretary-treasurer of Sun Oil Co.; comptroller is Edward C. Bevan and assistant secretary and assistant treasurer is R. A. Paul, Jr. Directors of the new company are Richard R. Anderson, director of production for Sun Oil Co., and Messrs. Bevan, Duke, Macht and Wilson. Headquarters for the new company will be 1608 Walnut Street, Philadelphia 3, Penna.

NIOC Opens New York Office

A United States branch office of the National Iranian Oil Co. has been opened at the Time and Life Building in New York City. Mr. Abbas Ghaffari, an Iranian citizen who has been living in the United States for many years, has been appointed manager of the New York office. The National Iranian Oil Co. intends to increase its commercial relations with American firms and to develop possibilities of technical consultations with American experts.

R. Noble

S. A. Adger

Milwhite Election

Sidney A. Adger has been elected senior vice president of Milwhite Mud Sales Co., Houston. He continues also as a director. At the recent annual meeting Ralph Noble of New Orleans was elected a vice president.

Hunt Combination Bit

A new combination bit has been developed by Hunt Tool Co. to combine the desirable features of both the drag and rock bit for soft and intermediate formations. The cones, cutting at and near the periphery of the hole, serve as a pilot, keeping the hole straight and to gage. In addition, the cones have a stabilizing effect, maintaining a constant rate of penetration. In this manner they prevent the drag type blades from penerating too rapidly at any one time and thus overloading the string with torque. The drag cutter, on the other hand, will remove formations at or near the center of the hole faster and more efficiently than a rock bit cone. In this way, maximum speed of penetration is accomplished at a uniform rate. This bit is available in sizes ranging from 12" to 18¾".

Changes Name To Halliburton Co.

A name long familiar in oil fields around the world —Halliburton Oil Well Cementing Co.—was changed to Halliburton Co. on July 5.

More than 99.9% of the voting Halliburton stockholders gave formal approval to the new name on June 28 at the company's annual meeting in Duncan, Okla.

The change was made because Halliburton provides a number of oil field services and products in addition to cementing and because the company has entered other industries to market several products and services originally developed for oil field use.

New Lummus Appointments

Robert T. Hennes has been appointed director of public relations and advertising, and Harold C. Heaslip advertising manager of The Lummus Co., New York. The announcement was made recently by Mr. J. F. Thornton, president of the world-wide firm of industrial engineers and constructors. Mr. Hennes was formerly the firm's advertising manager and Mr. Heaslip was assistant advertising manager.

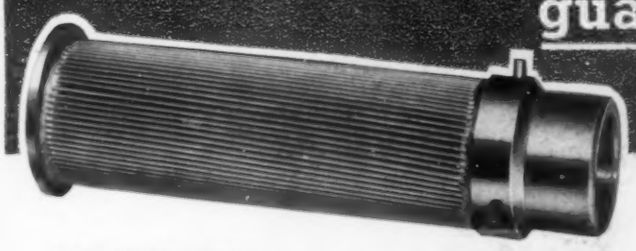
New Cementing Unit

Seven hundred brake horsepower that is controlled from a single location with finger tip control features an oil well cementing unit which has been delivered by Stewart & Stevenson Services, Inc. to the Mike Hicks Tools and Cementing Co. of Houston and Crowley, La.

When on an oil well cementing job, the unit is operated from a remote control console located on the operator's deck adjacent to the displacement tank. This remote control console features full remote shifting controls for all transmissions in addition to all of the engine instruments and controls. The operator can control both engines and both transmissions as well as all of the suction and discharge manifolding for the pumps from this centralized location.

All of the transmission and engine controls located in the special one-man cab are remote controlled through air and hydraulically operated remote control systems. Each 8V-71 engine is rated at 350 bhp output. The pumps will produce approximately 2 bbl/min at 10,000 psi; 4 bbl/min at 5,000 psi; 8 bbl/min at 2,500 psi, and 16 bbl/min at 1,250 psi.

Vokes new filter media with guaranteed 100% efficiency



POROLOY CM.

Vokes now introduce a new all metal filter medium of outstanding efficiency for the *controlled* filtration of hydraulic and lubricating oils, fuels, air, gases, acids, caustics and related caustic materials, chemicals and solvents at extreme temperatures and pressures. Poroloy CM filter elements can be made in any size or shape from a variety of metals—Stainless Steel, Inconel, Nickel, Copper, Steel and Nichrome being the most popular—features which, combined with special production techniques to give controlled pore configuration, enable filters to be individually designed for special applications. Metals can be selected with the particular requirements of the application in mind and the size of the pores can be controlled to deal with particles of between 2 and 250 microns. Poroloy CM filters are therefore 100% effective against a stated particle size, *the danger of media migration being eliminated by an accurately controlled sintering process.* The ultimate tensile strength of the elements varies from 2,000 to 60,000 p.s.i. and the operating temperature range is from —400°F to 1200°F.

The unique combination of properties found in Poroloy CM as led to its recent use in critical temperature conditions in the United States missile and aircraft industries, including installation in the Boeing 707.

POROLOY T.

Similar in performance to Poroloy CM but manufactured by a different process, Poroloy T has an operating temperature range from —400°F to 1500°F. Pore size ratings are from 2 to 250 microns and tensile strength varies from 2,000 to 100,000 p.s.i.

This illustration shows the many sizes and forms—seamless tubes, flat discs, corrugated elements etc.—in which Poroloy can be manufactured.

Both filter elements are manufactured in conditions of micro-cleanliness and before despatch are individually checked for performance in bubble point testing equipment.

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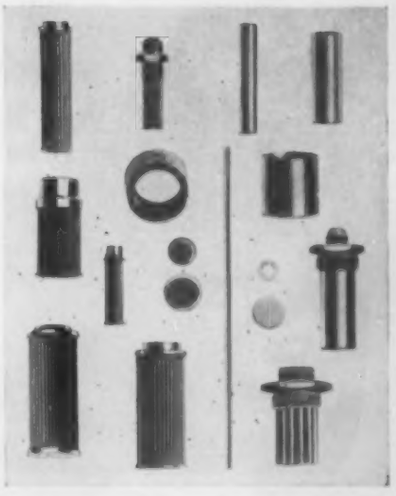

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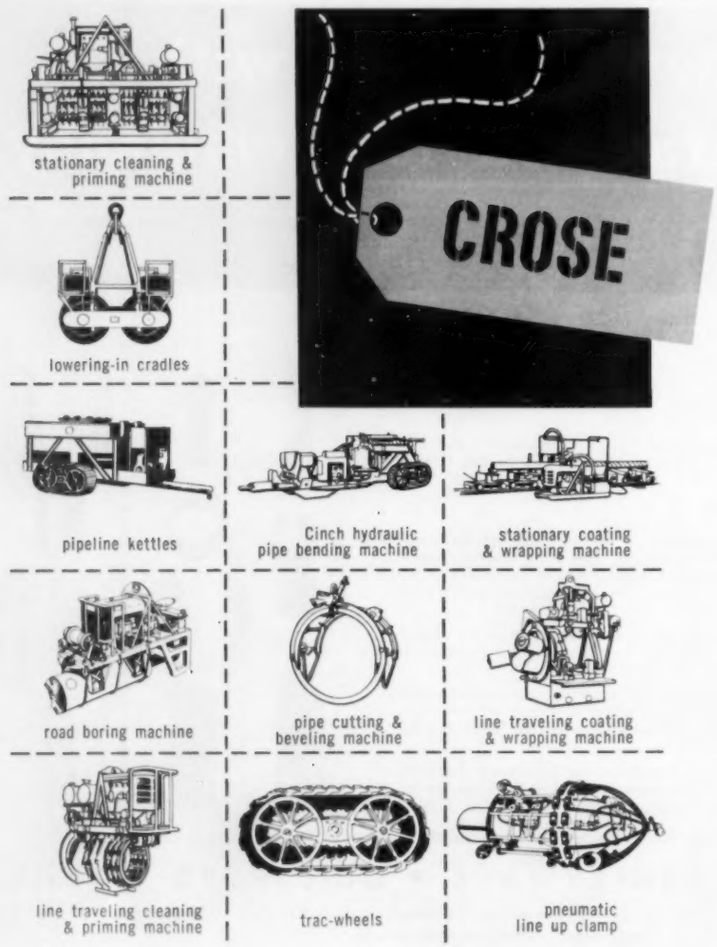

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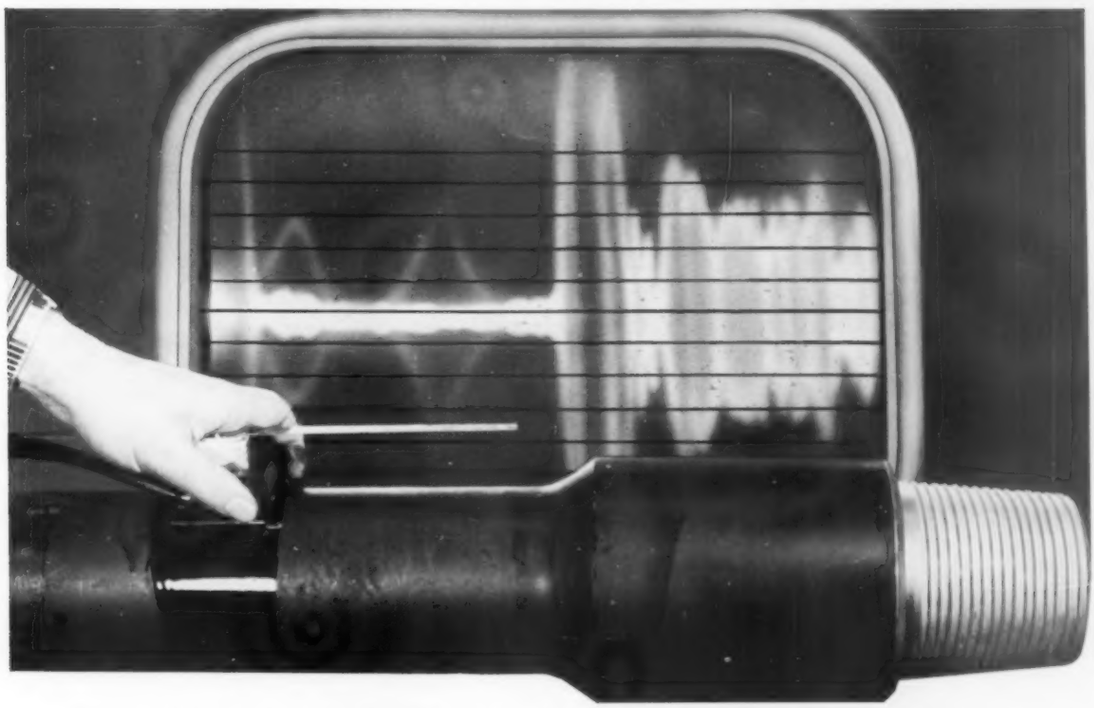

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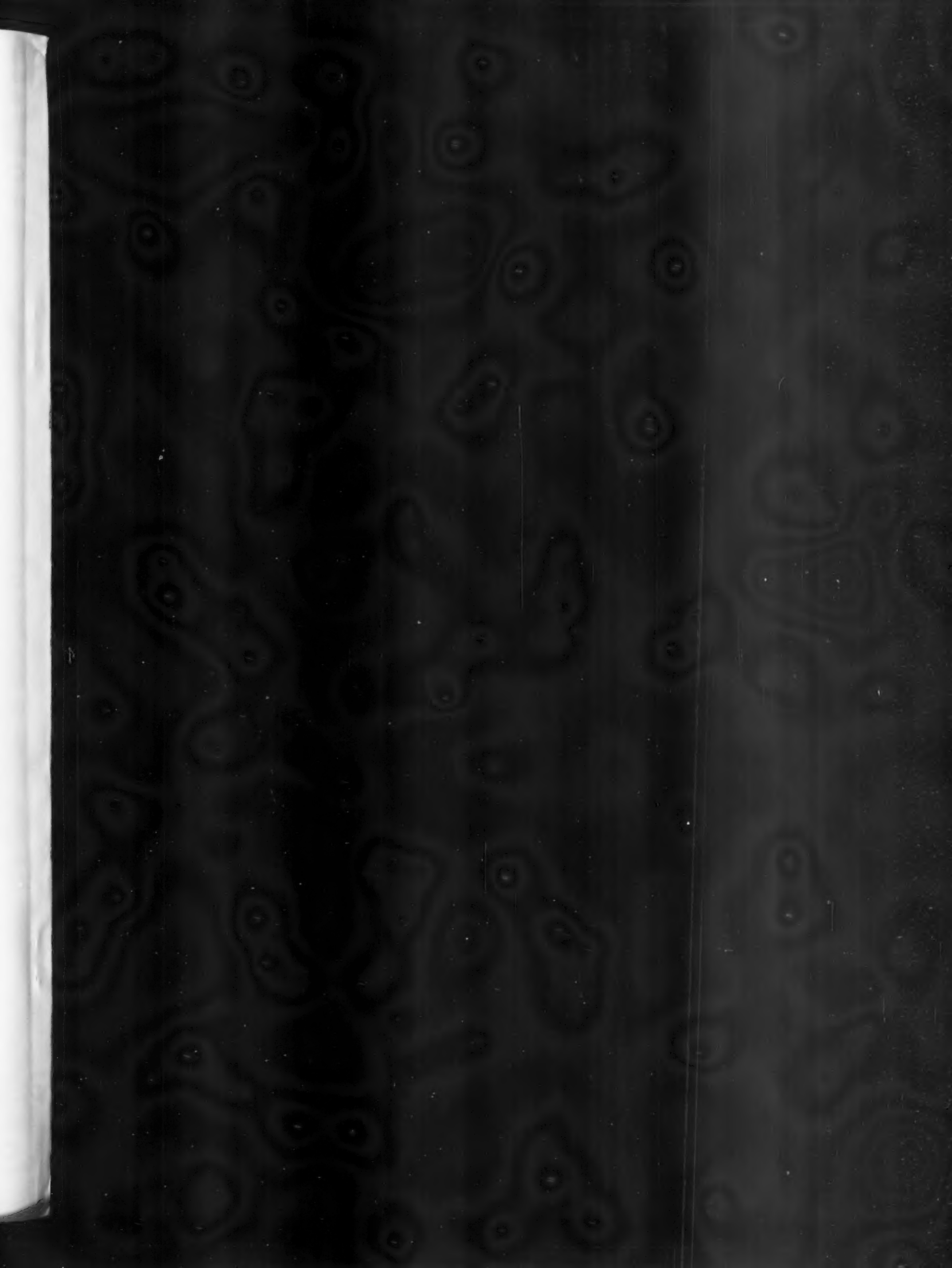
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